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JAPANESE AMMUNITION

C.I.AMM. TECHNICAL REPORT

No. 39

TYPICAL METHODS OF FILLING FOR A.P./H. E. BASE-FUZED SHELL

JAPANESE AMMUNITIONC.I.AMN. TECHNICAL REPORTSREPORT NO.39JUNE, 1945TYPICAL METHODS OF FILLING
FOR
A.P./H.E., BASE FUZED SHELLG E N E R A L

As the result of examination of various natures of A.P./H.E. Shell at Kirkee, it is now possible to summarise the methods of filling of Japanese A.P./H.E. shell of calibres up to 75-mm. For the larger calibres of 105-mm. and 150-mm. the same method of filling as for the 75-mm. is probably used. Actually no A.P./H.E. shell in these calibres has yet been examined at Kirkee, and no reports of any having been captured are available to date (June 1945).

2. The drawings at Plates A and B at the end of this Report show the more common methods of filling; those items which are marked with a "V" have been verified here and the details given are definitely correct. No rounds of 40 and 57-mm. calibres have yet been received at Kirkee, but the information given in the drawing has been taken from reports which have been carefully cross-checked for correctness.

3. Useful details such as nature of shell filling, shell diameters, and shape of head have also been included in the Plates. It should be noticed, contrary to British and American practice, that the Japanese do not use A.P. shot. Their A.P. projectiles invariably include a small H.E. filling; usual German and Italian practice. The use of a copper washer under the flange of the base fuze to prevent possible ingress of flash from the propellant should be noted.

4. Most shell have a cannellure about mid-way between the driving band and the base into which the neck of the case is cannellured, the mouth of the case being crimped immediately below the driving band. Owing to this cannellure and crimping it will be found that the case for A.P./H.E. shell is usually slightly shorter than the same case for nose fuze shell. Some shell have a slight taper at the base or in the adapter. This has nothing to do with ballistic performance, but is intended to facilitate assembly during the fitting of the shell in the cartridge case.

EXPLODERING

5. Similar to nose fuze H.E. Shell (C.I.Amn. Technical Report No.38) methods of filling are standardized, although perhaps not to the same extent. All 75-mm. A.P./H.E. shell examined have had the same size of fuze hole and the same type of fuze. The same applies to the 37-mm. and 47-mm. calibres; the same fuze hole and type of fuze is used in each. Owing to the small charge used no special exploding is employed. The fuze has usually a powerful gaine, which fits snugly into a cavity formed in the filling. This cavity has usually a paper lining. In the case of small shell, e.g., 37-mm. great care

is taken to ensure good detonation; a comparatively powerful gaine is used which fits to its full length into a perforated picric acid pellet. The need for an exploder container and special methods of sealing is not so essential owing to the fact that all A.P./H.E. shell are necessarily issued fuzeed and, as mentioned above, the fuze is screwed home hard on to a copper washer.

MAIN FILLINGS

6. The fillings used may, for convenience, be classed as below:-

- (a) Block Fillings. These follow normal practice; a precast pellet or a pellet pressed to shape and wrapped in waxed paper. In one instance, the 75-mm., an aluminium container is used. A cavity is formed at the time of pressing to take the fuze gaine. The filling may be made up in one or more pellets; the whole being finally wrapped in waxed paper. Owing to the difficulty of forming a block with a comparatively sharp point, wooden plugs are usually used to fill the nose of the cavity in the shell; the nose of the explosive block having the form of truncated cone to suit the base of the wooden plug. Felt washers are usually found on top of the filling at the shell mouth to take up the pressure when the fuze is screwed home. These felt washers are probably also intended to cushion the filling on firing. The fillings used are Picric acid, Picric Acid/T.N.T., T.N.T., and R.D.X./Beeswax.
- (b) Poured Fillings. There is no information to suggest that poured fillings are used in A.P./H.E. shell and none has been found among a large number of shell examined at Kirkee.
- (c) Stemmed Fillings. The only stemmed filling known is that for 47-mm. A.P./H.E. shell, which is ^{or} comparatively recent design (about 1941); the filling being R.D.X./Wax in the proportion of 90/10.

7. Detailed remarks on each type of A.P./H.E. shell are given below:-

8. 37-mm. See Plate A. The two pellets of pressed picric acid (one solid nose pellet and one perforated pellet) are wrapped separately in paper. The perforated pellet has a paper lining to take the fuze gaine. The two pellets are joined, with a felt washer between them, by a length of thin adhesive tape. Finally the complete unit is heavily waxed probably by dipping in melted wax. Analysis showed that ^a good quality picric acid was used.

9. The metallurgical report on shell manufactured in 1939 and 1940 showed that the composition of the steel was to all intents and purposes a plain carbon steel with a typical average V.P.H. on the exterior surface of 766 at $1\frac{1}{4}$ -ins. from the point of the nose to 276 at $2\frac{1}{2}$ -ins. from the point of the nose. The driving band was made of copper 99.95% purity.

10. 40-mm. See Plate A. This is reported to be a single precast T.N.T. pellet wrapped in waxed paper with a wooden

packing ring and a paper washer on top of the ^{filling} fitting over the fuze gaine.

11. 47-mm. See Plate A. This was a stemmed filling of 0.5 ozs of R.D.X./Wax in the proportion 90/10. The interior of the shell was lacquered with a stoved finish, and the filling stemmed in leaving a cavity for the fuze gaine. The surface of the filling was covered with a paper washer and then a waxed felt washer.
12. The metallurgical report on shell manufactured in August 1941 indicated that the shell composition was to all intents a plain carbon steel machined from bar similar to 37-mm. shell above. The report also stated that the characteristics were more those of an S.A.P. projectile than an A.P. projectile, and that considerable scope exists for improvement in technique and performance. Typical hardness figures on the exterior surface were V.P.H. 841 at $\frac{3}{8}$ -ins. from the point of the nose to 286 at $\frac{1}{2}$ -ins. from the point of the nose.
13. 57-mm. See Plate B. This drawing has been prepared from reports and it would appear that a comparatively large quantity of filling is used, even greater than that in the 75-mm. shell. It is estimated that the weight of filling of this shell is roughly 3.6-ozs. as against 1.9-ozs. for the 75-mm. A.P./H.E. shell. There is some doubt about the arrangement of the filling as reported. According to Japanese practice one would expect the explosive block in the nose to be T.N.T. and that taking the fuze gaine to be picric acid and not the reverse as shown.
14. 75-mm. This method of filling is somewhat complicated, in that the filling is pressed in two increments into an aluminium container of the shape of a truncated cone. A recess is left in the last increment to take a flanged aluminium cup which closed the mouth of the aluminium container; the walls of the container being turned over on to the flange of the cup. The gaine which is a separate unit is then screwed into the shell on top of a felt washer which takes the pressure (if any) of the gaine on the aluminium container. Behind the gaine the fuze is screwed in hard, the flange seating on to a copper washer. The filling is 1.9 ozs of R.D.X./Beeswax in the proportion of 90/10.
15. Metallurgical analysis of a shell manufactured in October 1941 showed that the composition used was to all intents plain 0.80% carbon steel. V.P.H. figures recorded on the exterior surface were 874 at $\frac{1}{4}$ -in from the point of the nose to 329 at $\frac{3}{8}$ -ins. from point of the nose.
16. One shell manufactured at Osaka in February 1942 and filled at Nagoya in July 1942 was detonated at rest in a fragmentation chamber to obtain a rough indication of the nature of fragmentation to be expected. Details are shown in Plate C.

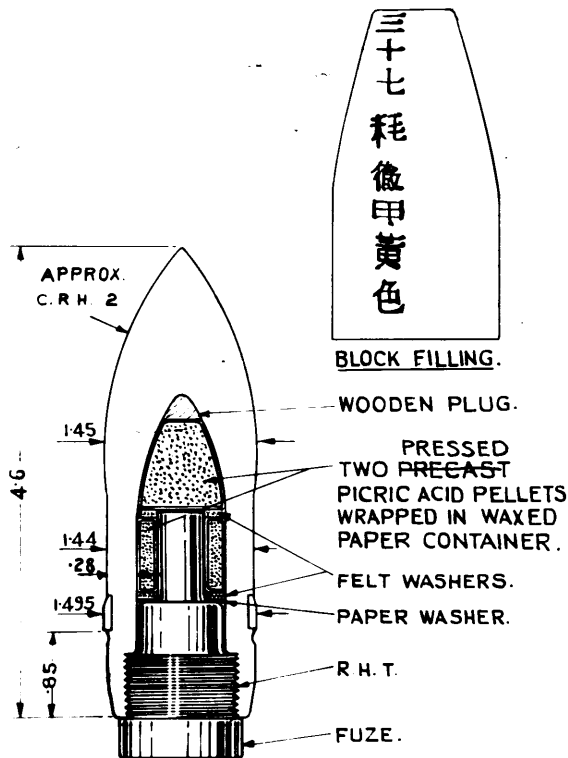
A P P R E C I A T I O N .

17. There is little to add to the details given above. The material used is good throughout and the finish is generally excellent. While the methods of filling used generally

follow orthodox practice there appears to be no design which resembles very closely any German or Italian design. No marked similarity exists between them and any British or American designs known here. The use of an aluminium container is of course similar to British practice with large calibre A.P./H.E. shell, mainly Naval.

18. Some brief metallurgical details of the shell examined by the I.M.S., Ishapore have been given earlier as a rough guide only. If further details are required these can be obtained through the Director of Armaments, M.G.O. Branch, G.H.Q.(I).

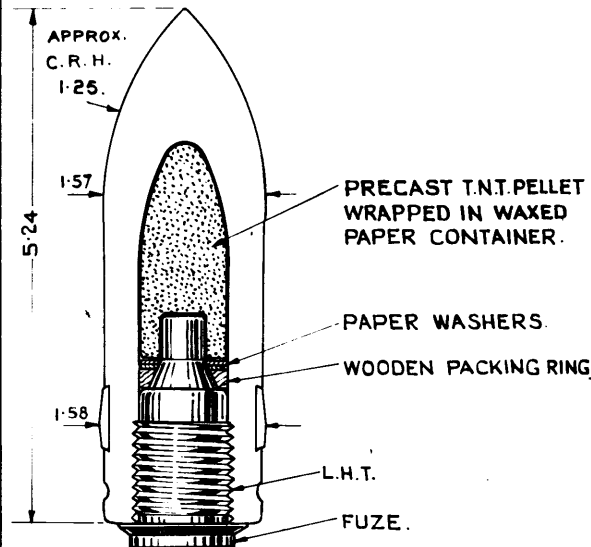
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① 37 MM.

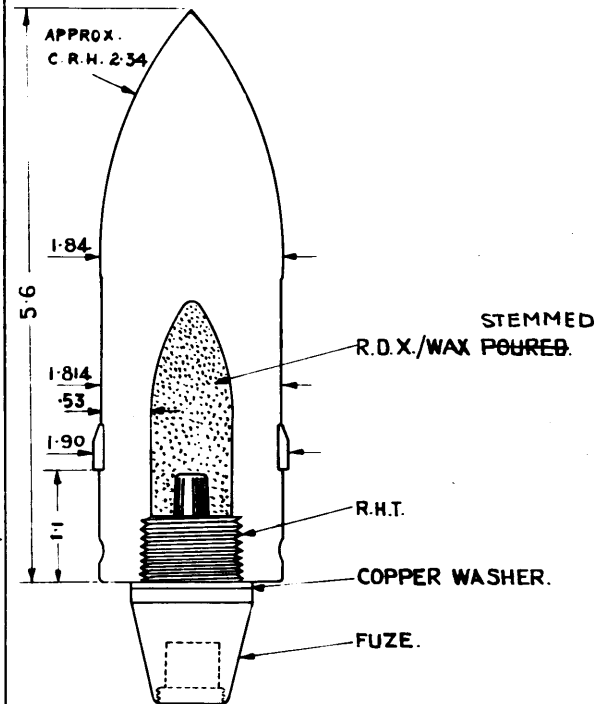
TAKING BASE PERCUSSION FUZE
(HOTCHKISS TYPE) 28 MM. FUZE HOLE.

(i) ONE WHITE BAND,
OR (ii) ONE WHITE BAND, ONE YELLOW BAND.



② 40 MM., JAPANESE MANUFACTURE.

TAKING BASE PERCUSSION FUZE
SHELL PAINTED WHITE WITH GREEN TIP



③ 47 MM.

TAKING BASE PERCUSSION FUZE,
WITH TRACER 24 MM. FUZE HOLE.

(i) ONE WHITE BAND,
OR (ii) ~~ONE YELLOW BAND.~~

DIMENSIONS IN INCHES

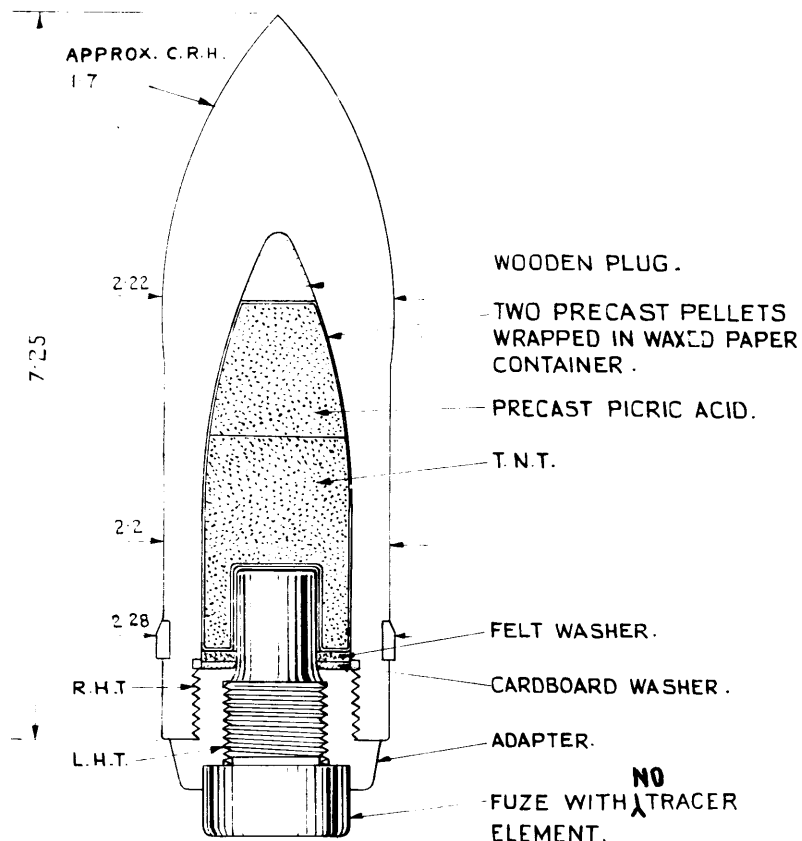
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37, 40 AND 47 MM.

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KIRKEE, APRIL 1945

PLATE A.

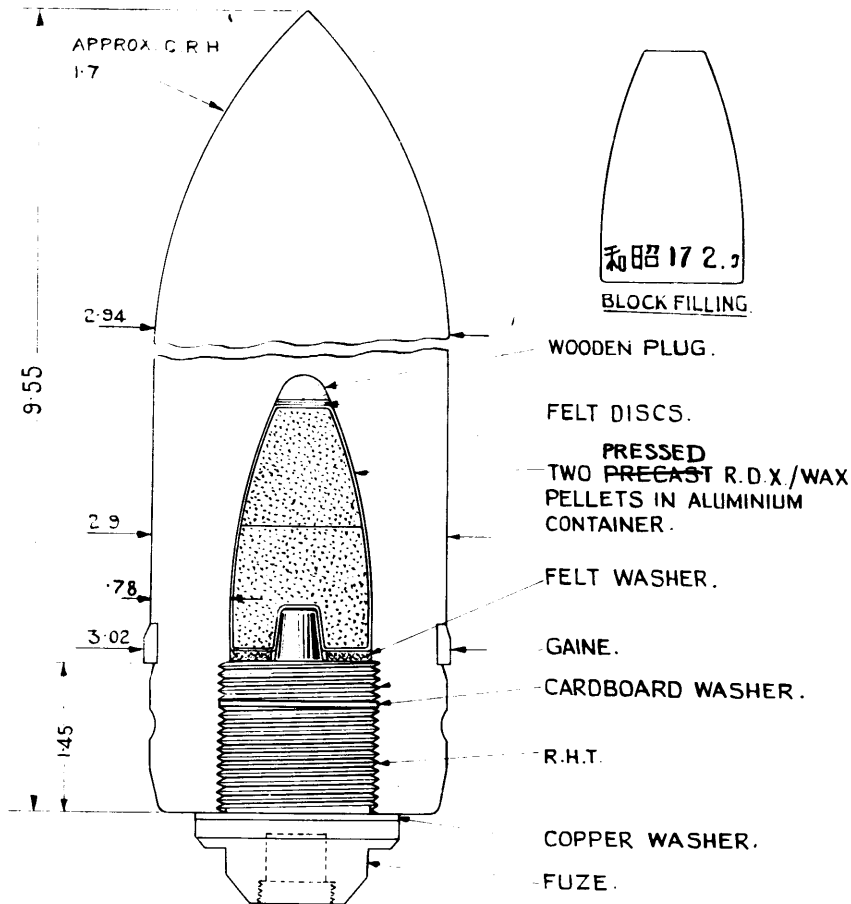
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④ 57 MM.

TAKING BASE PERCUSSION FUZE.

(i) ONE WHITE BAND.



⑤ 75 MM.

TAKING BASE PERCUSSION FUZE.
WITH TRACER. 40 MM FUZE HOLE.

(i) ONE WHITE BAND.
OR (ii) ONE WHITE BAND, ONE GREEN BAND

DIMENSIONS IN INCHES.

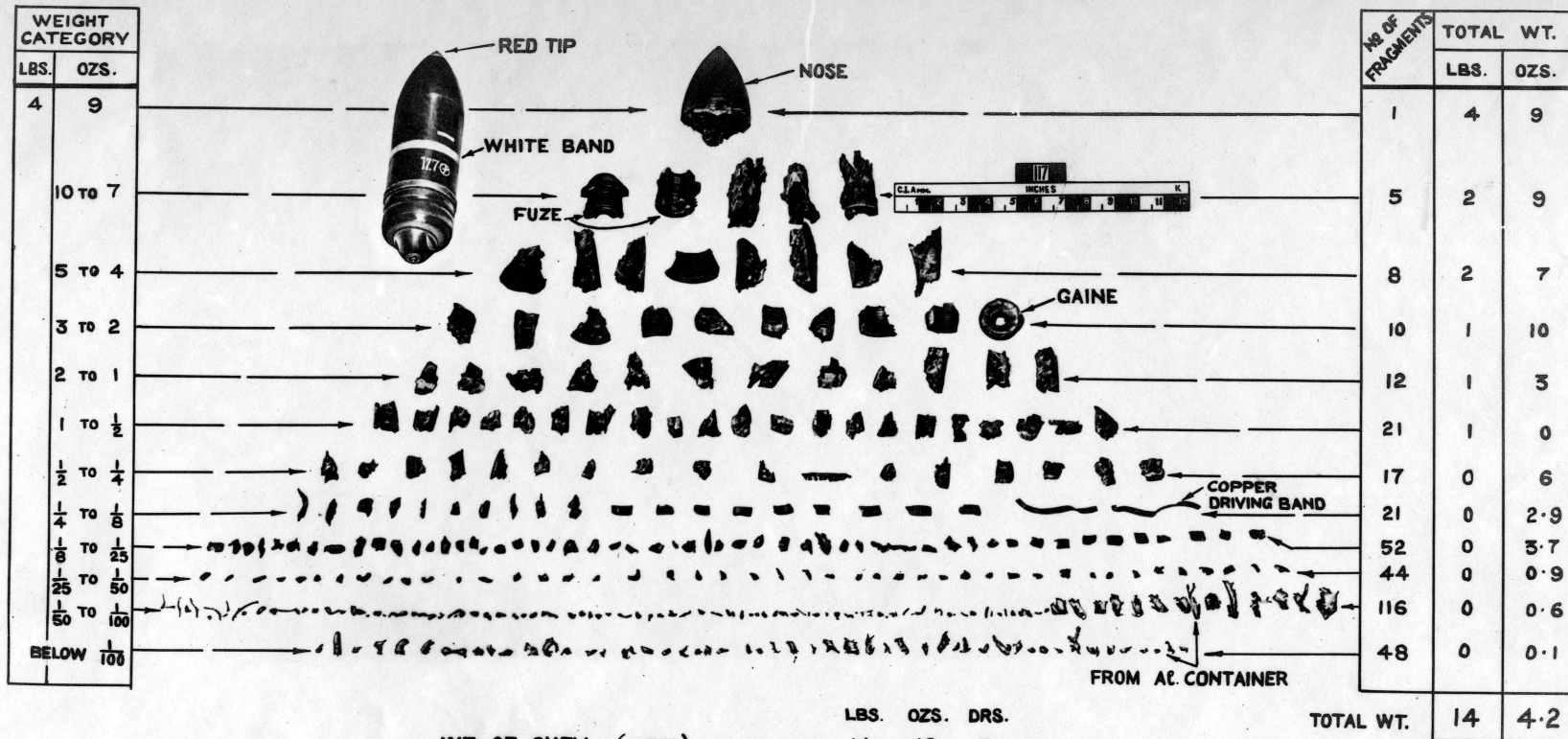
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57 AND 75 MM.

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PLATE B

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LBS. OZS. DRS.

WT. OF SHELL (FUZED) ----- 14 - 10 - 0

WT. OF EMPTY SHELL (WITH FUZE) --- 14 - 8 - 0

WT. OF RECOVERED FRAGMENTS ---- 14 - 4 - 3

PERCENTAGE RECOVERY ----- 98.3 %

H.E. FILLING-1.9 ozs. OF R.D.X. / BEESWAX 90/10

STATIC FRAGMENTATION

OF

A JAPANESE 75 mm. A.P. H.E. SHELL CASED FOR TYPE '94 MOUNTAIN GUN

MANUFACTURED OSAKA FEB. 1942 & FILLED AT NAGOYA IN JULY 1942.

CJ.AMM-S/1123
KIRKEE JUNE '45