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From: Chief, Naval Technical Mission to Japan.
To : Chief of Naval Operations.
Subject: Target Report - Japanese Incendiary Mixtures.
Reference: (a) "Intelligence Targets Japan" (DNI) of 4 Sept. 1945.

1. Subject report, covering Target O-27 of Fascicle O-1 of reference (a), is submitted herewith.
2. The investigation of the target and the target report were accomplished by Lt. Comdr. R.A. Cooley, USNR.



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O-27

JAPANESE INCENDIARY MIXTURES

"INTELLIGENCE TARGETS JAPAN" (DNI) OF 4 SEPT. 1945

FASCICLE O-1, TARGET O-27

DECEMBER 1945

U.S. NAVAL TECHNICAL MISSION TO JAPAN

SUMMARY

ORDNANCE TARGETS JAPANESE INCENDIARY MIXTURES

The properties, use, and chemical compositions of Japanese naval incendiary mixtures including rubber thermite, special phosphorous and explosive incendiary particles are discussed.

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REFERENCES

Sources of Information:

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Engineer M. MATONAKA, IJN, Ordnance Experiment Station, KURE Navy Yard.

Each of the above-mentioned persons contributed to the material of this report in a very cooperative and friendly fashion.

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INTRODUCTION

Development of incendiary mixtures for the Japanese Navy was carried out at the Chemistry Experiment Department of SAGAMI Navy Yard in HIRATSUKA City, KANAGAWA Prefecture under the direction of Lt. Commanders G. OKUDA and H. KUWABARA. Experiments on testing incendiary shells were carried out at the Ordnance Experiment Department of KURE Navy Yard, under the direction of Lt. Comdr. K. KOZU.

THE REPORT

1. Recent Research on Incendiaries

From testing and experience it was recognized by the Japanese Navy that ordinary thermite mixtures present the following difficulties when used in anti-aircraft shells:

- a. Ignition difficulties
- b. Lack of strength against mechanical stresses
- c. Uncontrollable combustion velocity

The overcoming of these defects was thought to lie in the addition to thermite of binding materials such as natural rubber, polysulfide synthetic rubber and electron metal.

Research was carried out along three lines:

a. Rubber Thermite

This incendiary material is plastic and may be pressed into any form. The chemical compositions of this type of thermite are given in section 4 of this report.

b. Special Phosphorous



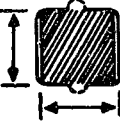
This incendiary material consists of phosphorous which has been treated to bring it into a molecular state whose properties are more suitable than ordinary phosphorous. It was stated that white phosphorous heated at 270°C for 10 to 20 hours and then solidified yields a product harder, and more brittle than the original and easily ignited by shock. This special phosphorous, a mixture of white and red phosphorous, does not spontaneously ignite in the air at room temperature but is easily ignited by mechanical shock. It is used in the Type 4 incendiary shrapnel shell and in the hand flame bottle.

c. Explosive Incendiary Particles

This incendiary material was still in the experimental stage but represented an attempt to incorporate pieces of explosive such as tetryl in a thermite space coating so that after combustion had reached a certain stage explosion occurred to spread incendiary particles.

2. Tabulation of Incendiary Shells

It was claimed that all reference material on the following data had been burned so that the following table may be incomplete or contain errors due to mistakes of memory:

Shell	Gun Used	Shape of Incendiary Pieces	Number of Incendiary Pieces	Composition of Incendiary
46cm Type 3			996	Rubber thermite
40cm Type 3	40cm Type 94	25mm incendiary pieces loaded in steel pipe	735	Rubber thermite
36cm Type 3			480	Rubber thermite
20cm Type 3			198	Rubber thermite
15.5cm Type 3			-	Rubber thermite
14cm Type 3		2.5mm	-	Rubber thermite
12.7cm Type 3		20mm incendiary pieces loaded in steel pipe	43	Rubber thermite
14cm Incendiary	14cm Submarine	Fan-shaped 	36	Rubber thermite
12.7cm Type 4		Steel pipe filled with phosphorous	Approx. 60	Special phosphorous
12cm Type 4		40 to 45mm 	Approx. 40	Special phosphorous
12cm R.I.S.*		20mm	Approx. 48	Special phosphorous

*R.I.S. - Rocket Incendiary Shrapnel

3. Chemical Composition of Incendiaries

The following table is vitiated by lack of documentary evidence but is probably accurate in most cases:

Material	Composition (%)			
	A	B	C	D
Polysulfide Synthetic Rubber	13	9.3	9.3	9.3
Natural Rubber	6.8	5	5	5
Stearic Acid	0.2	0.2	0.2	0.2
Sulphur	10	0.5	0.5	0.5
Carbon Black	5			
Potassium Nitrate	65			
Barium Nitrate		55	40	30
Electron Metal		30	45	10
Fe ₃ O ₄				25
Granulated Aluminum				20

4. Methods of Loading Incendiaries

Rubber thermite is pressed into the form required or into pieces of steel pipe for loading into the shell.

Phosphorous is cast in a can containing pieces of steel pipe and then the cans are loaded into the shell.

Special phosphorus is cast in pieces of steel pipe and these are packed in cans which are loaded into shells.

The arrangement of compositions A, B, C, and D for the Type 3 shell and for the shell of the 14cm submarine gun is shown in Figure 1.

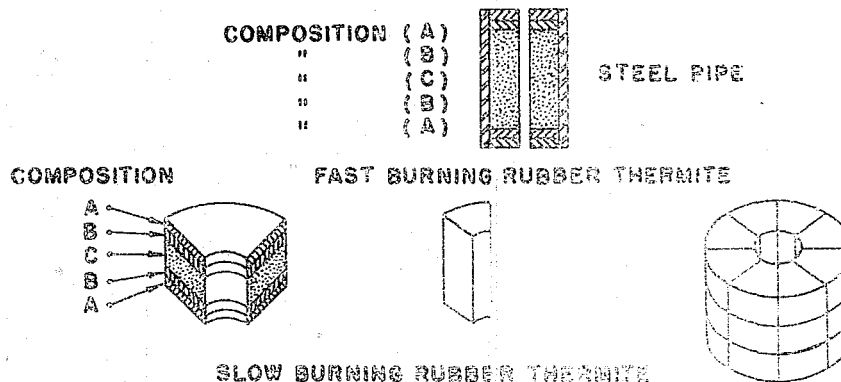


Figure 1
Incendiary Pieces for 20cm and 30cm Type 3 Gun Shell
and Incendiary Shell Arrangement for 14cm Submarine Gun Section

The incendiary pieces, or those packed in cans, are arranged as shown in Figures 2 and 3.

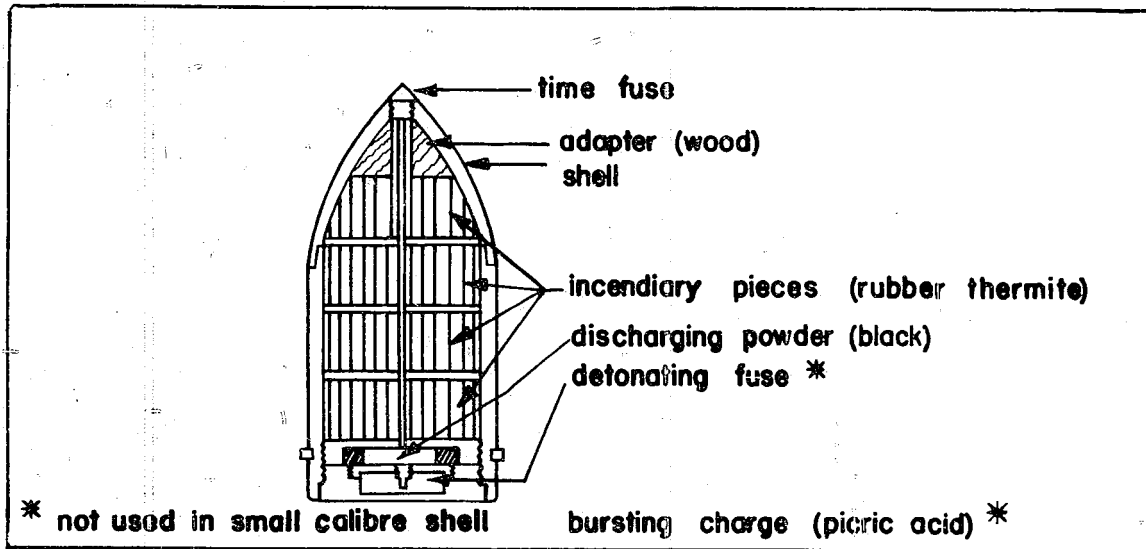


Figure 2
Arrangement of Incendiary Pieces in Shell

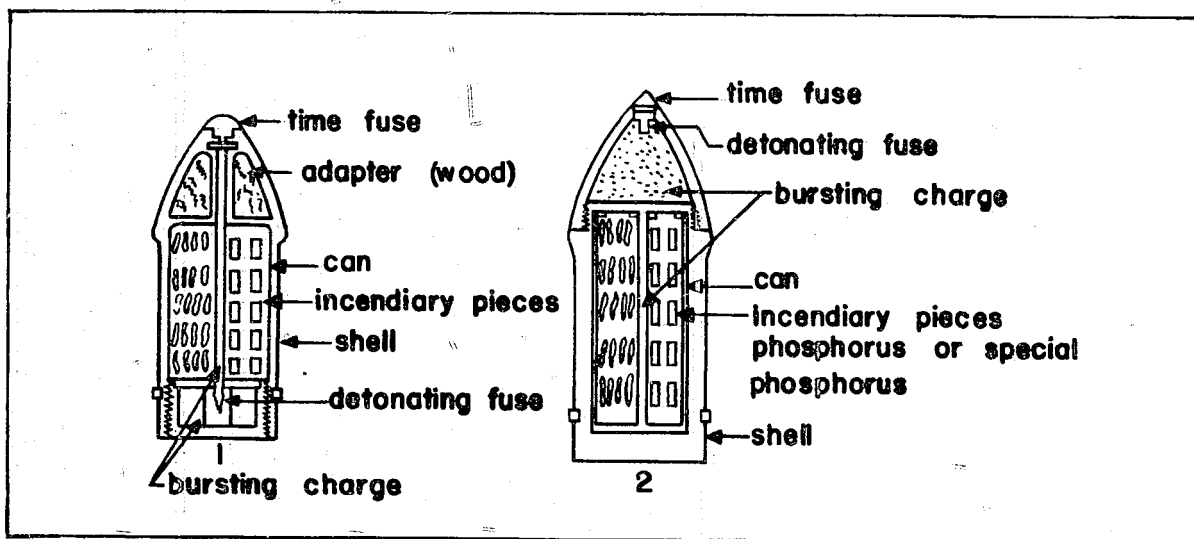


Figure 3
Type 1 and Type 2 Incendiary Piece Arrangement