

A-84-019  
41-13

UNCLASSIFIED

✓ C.F.  
✓ Tolman  
WSP

OFFICE FOR EMERGENCY MANAGEMENT  
NATIONAL DEFENSE RESEARCH COMMITTEE

OF THE  
OFFICE OF SCIENTIFIC RESEARCH AND DEVELOPMENT

1530 P STREET NW.  
WASHINGTON, D. C.

ADDRESS REPLY  
2101 CONSTITUTION AVENUE  
WASHINGTON, D. C.

JAMES B. CONANT, Chairman  
RICHARD C. TOLMAN, Vice Chairman  
ROGER ADAMS  
CONWAY P. COE  
KARL T. COMPTON  
FRANK B. JEWETT  
CAPT. LYBRAND P. SMITH  
MAJ. GEN. CLARENCE C. WILLIAMS  
IRVIN STEWART, Executive Secretary

September 11, 1943

~~CONFIDENTIAL~~

CLASSIFICATION CANCELLED  
PER DOC REVIEW JAN. 1973

Captain W. S. Parsons  
P. O. Box 1663  
Santa Fe, New Mexico

PUBLICLY RELEASABLE  
LANL Classification Group

VERIFIED UNCLASSIFIED

Dear Capt. Parsons:

*SA Brown FST-16 1/2/84*

*8/2 1/7/84*

I visited the Ballistics Research Laboratory at Aberdeen Proving Grounds Thursday and Friday (September 9 and 10) and obtained the following information:

1. Fraser's Ignition Powder. Lt. Joseph Fraser gave me one-half pound of his new ignition powder (2 Ti + K Cl O<sub>4</sub>), a mixture of titanium and potassium perchlorate. Dr. Fine took this over to Gibson, at George Washington University, who has an Explosives License and is having it shipped to Critchfield.

RECEIVED  
MAY 24 1999  
USTI

This powder gives a very hot flame and one grain of it is equivalent to 2.3 grains of black powder. Fraser has made a number of experiments using this igniter in rockets, but so far has not used it in guns. It is undesirable to use it in closed bombs as it deposits a slag which is difficult to clean out. There is every reason to believe that it should greatly reduce hang fire times. We found that it was readily ignited by a spark from a leak tester. The danger of this powder igniting accidentally is supposed to be less than for black powder.

The powdered titanium is purchased from the Metal Hydrides Company (Beverly, Massachusetts). It should not evolve H<sub>2</sub> when dilute H Cl is added; otherwise it is impure and dangerous to use. The potassium perchlorate is purchased as ordinary commercial grade and carefully recrystallized. It is important that no K Cl O<sub>3</sub> is present and also that the potassium perchlorate does not form lumps. A stoichiometrical mixture of 2 Ti to 1 K Cl O<sub>4</sub> is used. First 5 to 10% of the Ti is added to the K Cl O<sub>4</sub>

2225-1373



FINAL DETERMINATION  
UNCLASSIFIED  
L. M. Redman  
FEB 5, 1981

CLASSIFICATION CANCELLED  
PER DOC REVIEW JAN. 1973  
UNCLASSIFIED

UNCLASSIFIED

CLASSIFICATION CANCELLED  
PER DOC REVIEW JAN. 1973

~~CONFIDENTIAL~~

Capt. W. S. Parsons

Page 2

(to keep it from forming lumps) and the  $KClO_4$  is then passed through a 70 mesh screen. The Ti should be very dry. The mixing of the  $KClO_4$  and Ti is carried out in a motor driven mixer with nobody around. Two hundred grams are usually prepared at one time.

Fraser is also experimenting with a mixture of 2 Ti + Pb  $O_2$  (making sure no Pb O is present) which seems to have roughly the same properties as the 2 Ti +  $KClO_4$  mixture. The Pb  $O_2$  mixture is cast into a solid to make an alternate rocket propellant. It seems to give very good performance, having practically no temperature coefficient and almost eliminating the chuffing.

2. Hang fire times. J. R. Lane (under direction of R. H. Kent) wrote a report, A. P. G. No. 19, August 28, 1935, Effect of Length of Hang Fire on Velocity Dispersion. Length of hang fire decreases with increased density of loading. Velocity dispersion is less and pressure waves are less when hang fires are long.

75mm 1897

	Primer	$P_{cu}$	Hangfire
	49 gr	34150	.011 sec.
M 22 (75 gr)		9500	.014 - .019
		23000	.021
		27000	.010 - .015
		30000	.004 - .008
M 22 (150 gr)		9300	.009 - .014
		35000	.004 - .005

A P G No. 81 R. H. Kent, July 19, 1937

13 gr. Mod. M22 primer reduces probable error in muzzle velocity to 1.5 ft/sec. This is smallest primer which would set off charge.

CLASSIFICATION CANCELLED  
PER DOC REVIEW JAN. 1973

UNCLASSIFIED

CLASSIFICATION CANCELLED  
PER DOC REVIEW JAN. 1973

3225-1374

~~CONFIDENTIAL~~

Mr. Kent explained the ignition problem in the following way:

1). A good primer is long enough to extend into the center of the chamber. It has no holes near its base so that it shoots out jets of flame near the center of the chamber.

2). Ratio of diameter of bag to the diameter of chamber should be less than about 3/4. The base section of the powder bag should have a smaller diameter than the front section.

3). For lowest dispersion in muzzle velocity and smallest disturbance from pressure waves, the least possible igniter should be used.

Recent experiments by Lt. Burnham on the pressure-time and  $\frac{dp}{dt}$  vs t curves in closed bomb firings show:

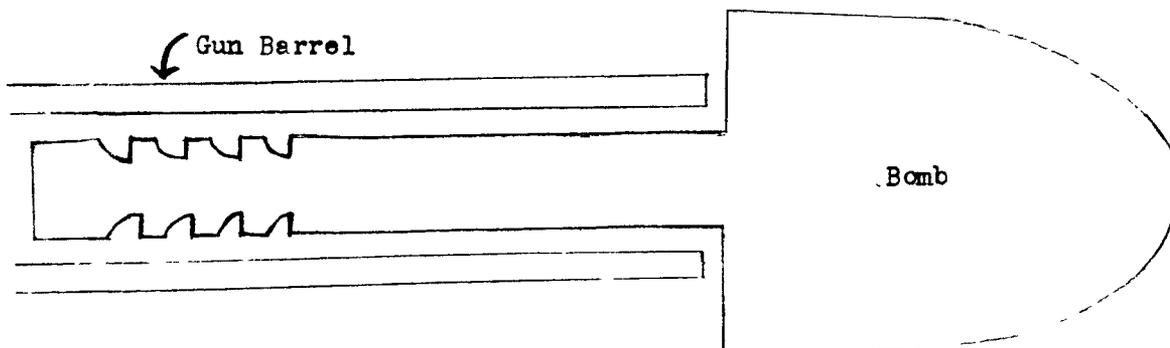
1). Gaseous ignition  $C_2 H_2 + O_2$ , etc., causes more pressure waves than black powder.

2). Gun cotton igniters have long hang fire and large pressure waves.

3). Small pressure waves almost always set in when the pressure reaches 9000 psi no matter what the ignition system, but the amplitude of these waves depends on igniter.

4). Kent believes that presence of burning solids in powder gas damps the pressure waves. This indicates that our best powder might be a mixture of fast and slow burning powder.

3. "Labyrinth" Obturation. The German spigot mortar has a smooth bore plug which fits into an ordinary 37 mm. gun. It has markings which look like



4  
7  
3  
1  
5  
2  
3  
2  
3

UNCLASSIFIED

CLASSIFICATION CANCELLED  
PER DOC REVIEW JAN. 1973

Capt. W. S. Parsons

~~CONFIDENTIAL~~

Page 4

The saw tooth markings are supposed to provide obturation. Mr. Zaroodney assured me that this was standard practice in turbine design. The saw tooth grooves produce vena contracta in the leaking gas so that it cuts down the effective free passages.

4. Prima Cord, (made by Ensign Bickford Co., New Haven or Hartford, Conn.) Dr. Thompson told me about the remarkable uniform velocity which might be expected from a HE fuze cord. Dr. Leslie Seely of DuPont Company is working on shaped charges at Aberdeen. Seely told me that Prima cord is the best commercial fuze used; it burns very uniformly. Seely has ignited a strand in the middle and taken X-ray micro flash films of the burning and found both ends are burned at the same rate (6000 meters/sec). This should be interesting to try. I am going to go back to Aberdeen next Saturday and learn more about it.

5. "Hair" Cordite. I learned that "hair" cordite is cordite W. M. (standard Canadian composition) with a web of .017 inches (32 in. long). It is used in British 25 pounder at the low zones and gives remarkable uniformity of muzzle velocities.

Joe Lane was not at Aberdeen this week and so I want to go back next week to see him before coming West.

Sincerely,

JH:nll

Joseph Hirschfelder.

(Not read by Dr. Hirschfelder after being typed)

3225-1376

CLASSIFICATION CANCELLED  
PER DOC REVIEW JAN. 1973

UNCLASSIFIED