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Weekly Report - Leon Fisher - Aug. 1 and 8, 1945

A. Effect of Inductance on Performance of 2 E 7 01 Spark Gap Lead Azide Detonators

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The isoparallel circuit has been used to determine the effect of inductance on delays.

[redacted] A triggered spark gap was used. All detonators were fired at [redacted] per detonator. The data are given in Table I.

[redacted]

DOE b(3)

DEPARTMENT OF ENERGY DECLASSIFICATION REVIEW
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These results show the lack of importance of inductance on the spark gap azide detonator. The inductance of the three types of circuit are estimated to be 1.6, 4.3 and 6.3 microhenries, respectively. Similar studies are in progress for the bridge wire PETN detonator.

B. Minimum Capacity for Satisfactory Performance of 1 Mil Pt. Bridge Wire Azide with Safing Spark Gap in Series

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In the report of July 26, 1945, a marked depe[redacted]3 on pressure was noted for spark gap azide detonators. [redacted]ation [redacted]

[redacted]

E. Simultaneity of Bare 1.3 mil Ag. Wire

Two shots (No.'s 630 and 631) were put off.

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These data are in contradiction, but can be explained on the basis that the light signal from the bridge wire is not intimately associated with the beginning of detonation.

F. Confirmation of Lowered Capacity Recommendation for 1.3 mil Ag. PETN Detonators

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[redacted]

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Shots 639 and 640 were soldered at Los Alamos, the rest at CIT. The data show that is probably satisfactory at . DOE b(3)

G. New Bridge Wire PETN Research

Many new bridge wires have been tried in 1 E 5 plugs. In Table V is given a description of the wire, manufacturer, resistance, and threshold. DOE b(3)

The number of detonators used for determining the threshold is given in parenthesis in the threshold column. PETN batch 118 was used. Also given in the table is the energy (in a condenser discharge) necessary to burst the bare bridge wire (as [redacted] The energy per unit volume necessary to burst the bridge wire is also given. These bursting energies are good to ± 10 percent. Oscillographic [redacted]

time pictures of loaded detonators have also been measured for the various wires. Absolute delays in bursting the bridge wire at 5000 volts are also listed. This last figure is the time from the beginning of the current trace to the first maximum.

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It should be noticed that the energy necessary to cause the bridge wire to "disappear" is (where data is available) much less than the published heats of vaporisation. This indicates that the particles exploding bridge wire do not leave in the vapor state.

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VI. Tm - Tmo is the difference of the average delay of the particular wire and the average delay of the 1.3 mil Ag. A negative value of this quantity indicates a Tm smaller than for the standard 1.3 mil Ag. detonators. All PETN was lot 116. It seems that type A, B and C are extremely good candidates for improving the detonator. On a rough inspection, these wires seem to be much sturdier than the present pure 1.3 mil Ag. being used. More data will be obtained on these wires.

Table VI

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of correlation between the delay in bursting of the bridge wire as measured on the oscilloscope and the comparative delays as measured directly on the camera. This leads one to suspect that the starting of detonation depends on wire species. Bare bridge wire simultaneity shots on the camera should settle this point.

In Fig. I are plotted threshold vs. diameter data for 80 -15 -5 wire.

A rather striking result of the present study is the excellent performance of advance which has a resistance about 25 times as large as 1.3 mil Ag. The threshold for advance, however, is higher.

H. Threshold of 1.3 mil Ag. PETN detonators as a function of inductance

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[redacted]

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The data are plotted in Fig. II.

I. Mechanixm of detonation of lead azide by means of a spark gap

It has long been tacitly assumed that lead azide spark gaps detonate by means of a spark. Oscillographic pictures show that the detonation is not associated with a heavy current flow through the gap. Other experiments performed by Schmidt show that a series of gaps must "see" each other with ultra violet light in order that all may spark simultaneously. Obviously in loaded detonators the gaps do not "see" each other, and yet they go with good simultaneity. This leads one to believe that the mechanism of detonation in azide spark gaps is one which is independent of external ionization. This mechanism might be the polarization of the lead azide molecule in the extremely high field regions between the pointed electrodes. Experiments (on low priority) are going on to answer this question.

More careful correlation of the data presented in this report with thermal and electrical data will be made in the near futures

dc: T. Lauritsen
Fowler
Roach
Sage
Yost
Bacher
Greisen
McMillan
Lofgren
Bradner
Buchanan
Fisher
Knudsen
McDonald
Seely
Vogel
Fussel

Supplementary Note on Tensile Strength Of Wire Types A, B, and C

Since wires A, B and C look very good, their tensile strengths were measured. The data are given in Table VIII.

Table VIII

Tensile Strength

Type A	97,500 lbs/in2
Type B	106,000 "
Type C *	89,000 "
1.3 mil Ag.	31,500 "

* Erratic, some samples gave values as low as 50,000 lbs/in^2.

Types A, B, C, are all stronger than the present standard wire. Also the 1.3 mil Ag. definitely yields before breaking.

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[redacted]

TABLE V