

A-54-019
40-20

~~SECRET~~
UNCLASSIFIED

Copies. August 22, 1944
of 7
23 Aug

J. O. Hirschfelder and W. C. Penney

**CLASSIFICATION CANCELLED
PER DOC REVIEW JAN. 1973**

R. W. Carlson

UNCLASSIFIED
L. M. Redman
FEB 4, 1981

Further Comments on Static Strength of Jumbo.

PUBLICLY RELEASABLE
LANL Classification Group

VERIFIED UNCLASSIFIED

The probability is acknowledged of a sustained pressure as high as 8000 p.s.i. in Jumbo No. 2 due to the explosion of 4500 lb. of Composition B. This corresponds to an effective energy of the explosive of 1100 calories per gram, and an effective specific heat ratio of 1.27. Preliminary estimates were based on 1000 calories per gram and 1.20 ratio, respectively, and these yielded a sustained pressure of only 5100 p.s.i. Although the lower figures were accepted tentatively on the advice of experts, it was admitted that higher figures might prevail. Consequently Jumbo No. 2 was designed accordingly, without gambling on the sustained pressure being as low as 5100 p.s.i.

In view of the uncertainties regarding several factors governing the safety of Jumbo No. 2, provision was made not only for testing scale models, but also for strengthening the vessel if necessary. Some of the uncertainties are as follows:

1. While it appears now that a sustained pressure of 8000 p.s.i. is likely, this pressure has not yet been proved by experiment.

2. The weight of explosive to be used may be different from the 4500 lb. assumed.

3. The actual strength of the steel is not known for the peculiar loading conditions; Gians shows 30% higher strength for mild steel stressed in 5 milliseconds (nearly our condition) than for similar steel stressed for 2 minutes as in the usual tension test.

4. The ductility which will prevail in the steel of Jumbo No. 2 cannot be estimated reliably, and

5. The rate of decay of the sustained pressure is indefinite; our calculations show a drop of 20% in 3 seconds, and nearly 40% in 20 seconds (it is believed that a stress near the ultimate strength of the steel can be endured for at least a few seconds, as for example in a tensile test).

Should the first models of Jumbo No. 2 be unsafe, which is likely, at least two strengthening features can be added. First, the cylindrical section can be made thicker merely by adding more bands. Also, the hemispherical ends can be strengthened by adding weight to the outside, for example by casting concrete around them. The adding of weight to the outside does not strengthen the shell against static pressure, but it relieves the shell of a large part of the shock. It is believed that the shell can support some shock plus a sustained pressure which drops from 8000 p.s.i. initial to a safe value of perhaps 5000 p.s.i. in a number of seconds.

**CLASSIFICATION CANCELLED
PER DOC REVIEW JAN. 1973**

R. W. Carlson

RWC:br
cc: Bainbridge
Parsons

Kistiakowski
Oppenheimer

UNCLASSIFIED

R. W. Carlson

0940