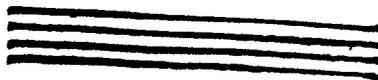


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MEMORANDUM

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P. Palatka 1/7/81

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LANL Classification Group

11 November 1944

P. Palatka 1/7/81
TO:

Capt. Ackerman and Lt. Jopper

FROM: G. B. Kistiakowsky

SUBJECT: Effect of Imperfections in H. E. Castings

FINAL DETERMINATION
UNCLASSIFIED
L. M. Redman
NOV 06, 1980

Messrs. Hugh Bracner and T/4 Carl Crumb have carried out an extremely interesting series of measurements on the effect of imperfections in H. E. castings, which are described in a Progress Report by Crumb dated October 26, 1944. While the work is not quite complete it had to be stopped because of pressure of other problems, and hence it seems appropriate to call it to the attention of all those interested, and to summarize it here briefly.

When one attempts to reason a priori the effect of cavities upon the detonation wave in a cast explosive, one is led to the following estimates:

(1) Very small cavities (i. e. small compared to the dimensions of the detonation wave and reaction zone) result in an effect similar to the reduction of the average density of a cast explosive, since after all such reduction is so accomplished by the creation of many microscopic cavities.

(2) Cavities of moderate size probably result in an overall speeding up of the detonation, if one extends to them observations made at ERL on cylindrical charges with long co-axial holes, the reason for that being that shock wave in air in the beginning propagates faster than the detonation wave.

(3) Very large cavities result again in a slowing down of the apparent detonation because the shock wave in air slows down and there may be additionally delays in initiation of the explosive at the far end of the hole when the shock wave is weak.

The experiments of Bracner and Crumb indeed confirm these general predictions and additionally define them so that quantitative estimate of the effects of imperfections can be made. Namely, they find that voids under 4 mm. average dimensions produce no visible effect, as far as distortion of the detonation wave is concerned. Voids of greater dimensions than 4 mm. cause an acceleration of the detonation, so that bulge is produced which is approximately spherical shape regardless of the void shape.

It is probably important to note that according to these experiments the bulge formed by the larger voids disappears in a distance of something like four times the average dimension

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of the void, after passing the void. This observation is extremely valuable in that it defines a minimum distance and the maximum diameter of voids which can be tolerated near the taper sprue. It is quite possible that in addition to distorting the shape of the wave the voids affect also the impulse and this effect may be serious enough to require even more rigid quality specifications. However, it is certain already now that cavities at distances less than the one specified above must make the casting unacceptable for all quality work.

G. B. Kistiakowsky

GEK:he

Copies to: Bacher
Bradner & Crumb
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