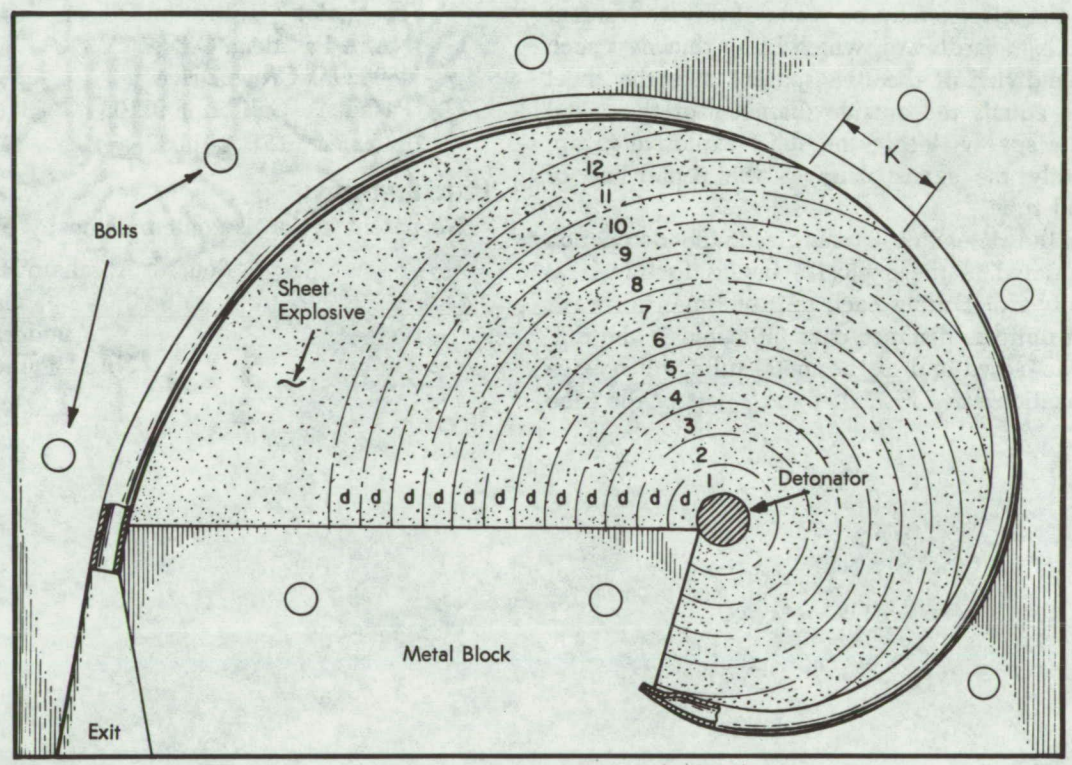
NASA TECH BRIEF

NASA Pasadena Office

Velocity Accelerator for Particles



The problem:

It is desirable to accelerate particles to velocities approaching 20 km/sec so that the efficacy of spacecraft meteoroid shields can be evaluated. Explosives are ordinarily used as an energy source to produce high velocities, but since detonation rates are of the order of 9 km/sec, some method must be found to increase the effective detonation rate.

The solution:

Sheet explosive and a metal tube are fitted to the inner periphery of a cam-shaped chamber.

How it's done:

A cam-shaped cavity is machined in a heavy block of metal, as indicated in the diagram; a heavy metal cover is fabricated to fit over the cavity block. The

(continued overleaf)

cover must be capable of being tightly fastened to the cavity block with strong bolts. The depth of the cavity is sufficient to accommodate the outer diameter of a thin metal tube that is closed at one end and made to conform with the shape of the cam. A hole at the position shown in the diagram is bored through the cover so that the bottom end of a small cylindrical detonator (a blasting cap) can come into contact with the surface of the sheet explosive. In order to assure detonation, a metal backing plate is located below the explosive and in line with the axis of the blasting cap.

A thin sheet of commercially available explosive is cut to fit the inner contour of the metal tube and the exposed sides of the cam-shaped cavity, as indicated in the diagram. Two spacers of the same shape are cut; the spacers may be made of any convenient material, e.g., cardboard, which has a thickness such that a sandwich of the two spacers plus the sheet explosive equals the outside diameter of the metal tube. The spacers locate the sheet explosive in approximately the same plane as the center-line of the metal tube.

When the detonator is energized, the detonation wave initiated in the explosive begins to travel radially outward. During each unit of time, the wave travels a uniform distance d as indicated in the diagram. The closed end of the metal tube will receive the detonation wave first; then each part of the tube will receive the wave front in succession with the open end receiving it last. The action resembles the extrusion of toothpaste from a tube. Note, however, that during time interval 11, the detonation wave has compressed the metal tube along a length K in the same time interval that the detonation wave traveled radially the distance d; clearly, the rate of collapse of the tube is much greater than the detonation rate.

The contour of the cam-shaped surface can be varied so as to give a desired rate of collapse which is controllable between wide limits.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
NASA Pasadena Office
4800 Oak Grove Drive
Pasadena, California 91103
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Patent status:

No patent action is contemplated by NASA.

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