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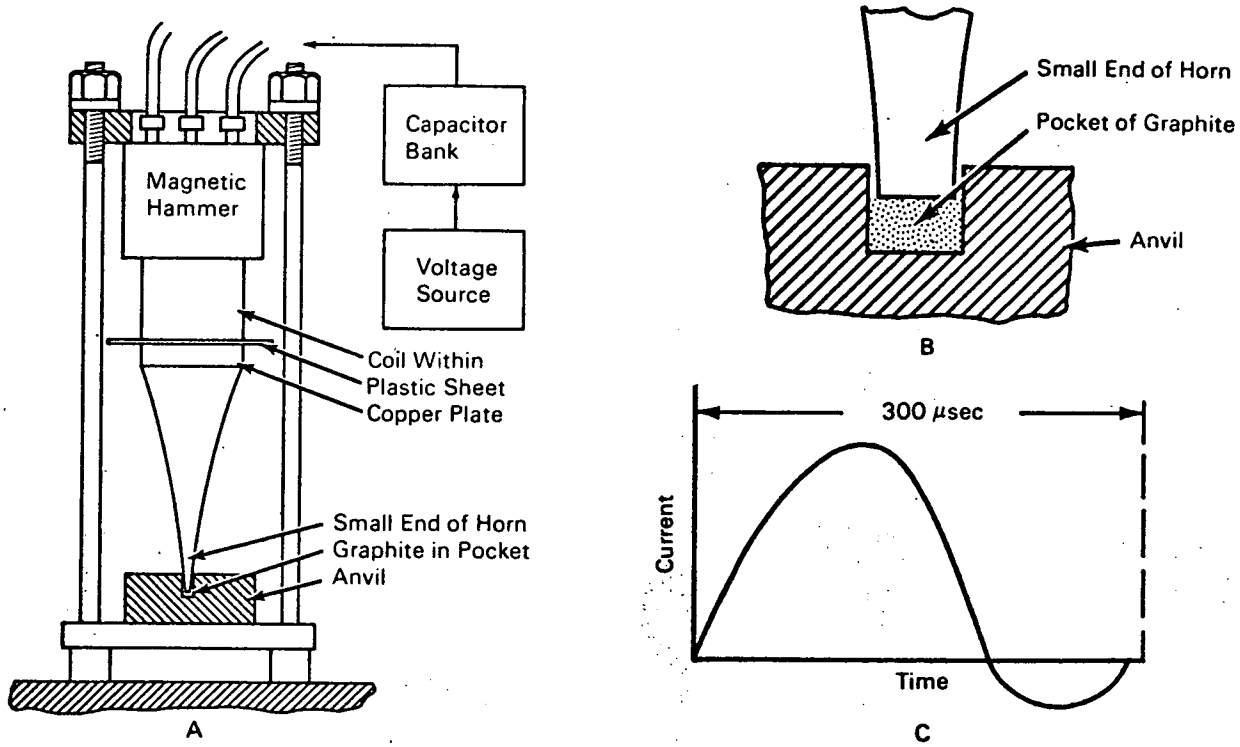
NASA TECH BRIEF

Manned Spacecraft Center

Synthesis of Diamonds

Clear or yellow industrial-grade diamonds can be synthesized from graphite with a novel and relatively light apparatus.

A copper plate rests over the large (upper) end of a solid exponential horn made of hardened steel (Fig. 1A). A magnetic hammer, abutting the copper plate, functions with the plate to create a downward shock wave in the horn. Through the small (bottom) end of the horn, fitting snugly in a small pocket in an anvil (Fig. 1B), the shock is transmitted to a charge of graphite in the pocket; the heat and pressure thus generated convert at least part of the graphite to diamonds. The hammer, copper plate, horn, and anvil are assembled within a bolted frame.



Sections of Apparatus (A), Small End of Horn (B), and the Shape of the Current Pulse (C).

A bank of capacitors delivers a fast-rising current pulse (Fig. 1C) to the coil in the bottom of the magnetic hammer; the prototype's bank had a capacity of 360 μF. The coil is separated from the copper plate by a plastic sheet to prevent arcing. The resultant complex of magnetic field, eddy currents, and mag-

(continued overleaf)

netic field, in and around the coil and the plate, tends to drive apart the hammer and the plate (which are constrained within the frame). The shock wave traveling down the horn is velocity-amplified and concentrated (because of the critical shape of the horn) so that all energy arrives at the small end substantially simultaneously. The shock wave entering the graphite and forming diamonds is in effect a very rapid pressure front.

The voltage applied to the capacitor bank was varied. A 1000-V charge was used to tamp the graphite in the pocket. Subsequent charges of 3000, 4000, and 5000 V produced yellow, brighter yellow, and clear diamonds respectively.

Note:

Requests for further information may be directed to:

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Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to:

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