Pyrotechnic Actuator for Retracting Tubes Between MSL Subsystems

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An apparatus, denoted the “retractuator” (a contraction of “retracting actuator”), was designed to help ensure clean separation between the cruise stage and the entry-vehicle subsystem of the Mars Science Laboratory (MSL) mission. The retractuator or an equivalent mechanism is needed because of tubes that (1) transport a heat-transfer fluid between the stages during flight and (2) are cut immediately prior to separation of the stages retractuator. The role of the retractuator is to retract the tubes, after they are cut and before separation of the subsystem, so that cut ends of the tubes do not damage thermal-protection coats on the entry vehicle and do not contribute to uncertainty of drag and consequent uncertainty in separation velocity.

The retractuator was conceived as a less massive, less bulky, and more powerful alternative to a traditional spring-actuated retractor. The retractuator is a modified version of a prior pyrotechnically actuated cutter. The modifications include alterations of the geometries of pyrotechnic charges, piston, and cylinder; replacing the cutter blade with a push rod; and other changes to reduce weight, arrest the piston at the end of its stroke, and facilitate installation.

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