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Vibration-Induced Rectified Motion of a Piston in a Liquid-Filled Cylinder with Bellows to Mimic Gas Regions J.R. TORCZYNSKI, L.A. ROMERO, J.R. CLAUSEN, T.J. O'HERN, Sandia National Laboratories — The motion of a piston within a cylinder is investigated. A spring suspends the piston against gravity. The cylinder is filled with a viscous liquid and has compressible bellows at the top and bottom to mimic gas regions. A fixed post with protrusions extends into a hole through the piston with opposing protrusions. The length of the gap formed by the protrusions depends on the piston's vertical position. The outer gap between the piston and the cylinder is extremely small. Hence, as the piston moves, the displaced liquid passes through the variable-length gap, and the liquid force on the piston depends on its position. When this system is subjected to vertical vibrations, this dependence can produce a nonzero net force. With bellows, this net force can become large enough for the piston to compress the spring. Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

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