Inverting Pop Tops
TOP-300 / TOP-305 / TOP-330 / TOP-335

Instructions:

With the hemispherical bottom downward, spin the stem of this top and release it onto a flat surface. The top will spin for a few moments and then mysteriously invert so that it continues spinning on its stem with the heavier hemispherical bottom lifted. Jearl Walker in Roundabout, The Physics of Rotation in the Everyday World (W. H. Freeman and Company) describes this top as "the most fascinating top I have ever encountered."

Explanation:

When the top is spun, the frictional force on the hemispherical bottom causes the top to start precessing. This sliding frictional force creates a torque on the spinning mass, which causes the top to invert. A hard-boiled egg can also be used to show this phenomenon. When the egg is spun on its side, it will rise up to spin on its end.

Jearl Walker writes in the October 1979 issue of Scientific American:

"The motion appears to violate the law of conservation of energy because the top seems to raise its center of mass (which is in the spherical section) without outside help.

The top has long fascinated observers, including several distinguished physicists and mathematicians. In a recent paper, Richard J. Cohen of the Massachusetts Institute of Technology describes how William Thomson (the eminent physicist better known as Lord Kelvin) spent his time spinning smooth stones on the beach instead of preparing for his mathematical examination at the University of Cambridge. Later Niels Bohr, who developed the first modern model of the hydrogen atom, became similarly entranced with the mechanics of the Tippe Top."

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This beautifully crafted top does for angular momentum what Newton's Cradle does for linear momentum. When spun, it starts out horizontal and then, surprisingly, stands upright. Wow! In the process, it illustrates the difference between equilibrium and stability. The rise of the "center of mass" is a fascinating physics problem. It will spin for minutes on end, producing a marvelous optical illusion as it slows down.

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