Reprinted with Permission of Journal of Recreational Mathematics and Baywood Periodicals. JRM, V. 4 No.1 Jan 1971 pp 55-57. *(these PM were made and work well)*

Polyhedron Mousetraps

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It is said that if you could invent a better mousetrap the world would beat a path to your door. Unfortunately, a mathematician's idea of a mousetrap is not a better mousetrap but much worse. However, there are some intriguing aspects of strictly geometrical mousetraps that make them worth considering aside from mice.

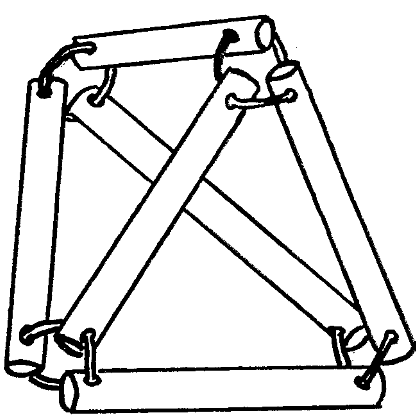
A Polyhedron Mousetrap can be defined as a geometric object constructed by connecting a set of rigid bars together at vertices with rubber bands or a similar elastic material. The bars serve as edges of the resultant figures.

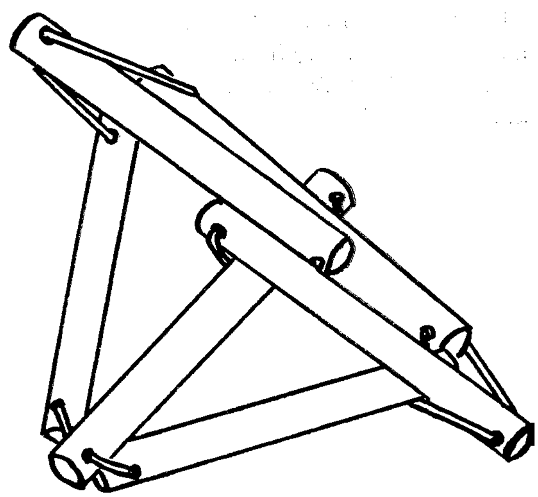
Any figure which collapses unless its vertices are rigid will not retain its intended three-dimensional shape and therefore will not work as well as figures having all triangular faces.

The three regular polyhedrons, tetrahedron, octahedron, and icosahedron, are particularly interesting as polyhedron mousetraps. These are shown in Figures 1, 2, and 3. Two methods of construction are shown.

The icosahedron should be made as shown with rubber bands passing through tubes. This makes the dynamic forces even, and the figure restores itself perfectly when tripped. The icosahedron is rather difficult to set and unless the diameter of the bars is one-fourth or more of their length it will not restore itself when dropped.

FIGURE 1.





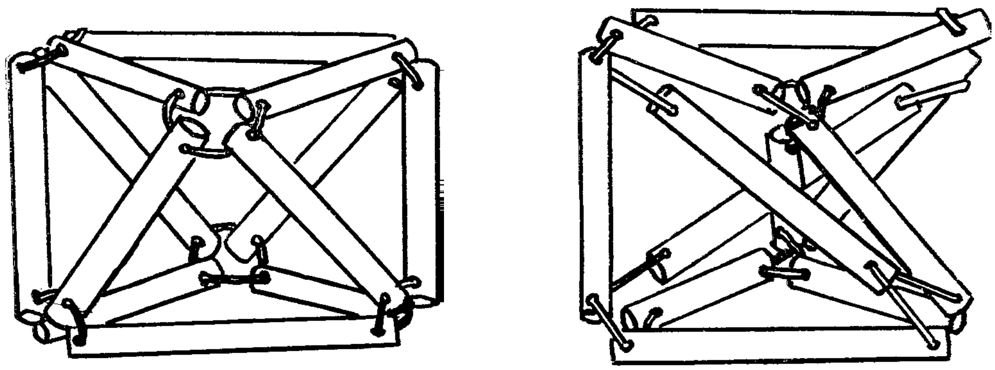


FIGURE 2.

The tetrahedron turns into a plane triangle when set so it may be called a tetra-tri-trap. The octahedron remains an octahedron as shown in Figure 2 and it is called an octa-self-trap. The isosahedron degenerates to an octahedron when opposite faces are twisted 240°. We might call it the icosa-sub-octa-trap. Their pure names would be tetratriane, octaselfane, and icosasuboctane.

The chemical names refer to the possibility of simulating some of the less explosive but nevertheless real changes that. a molecule might undergo. The benzene ring is a particularly interesting compound in this respect. It has a different chemical property depending on what shape it is in.

However, the icosasuboctane compound, if it exists or can be made would be completely different in its two forms and a chemist would be quite pleased to have been able to understand the reason for its different properties.

Such a compound would undergo a large volume change if it is tripped from the octa to the icosa form and might result in an explosion. This explosion would be quite odd if it suddenly spread out to fill a larger volume rather than becoming a gas. This substance would be quite useful in submarines if it had the right density. It would also be useful as a hydraulic fluid in an emergency.

More of these structures can be found. They should be investigated both for fun and for their chemical simulation properties.

(The chemical stuff was written more in fun than serious but no doubt chemicals do have all sort of rearrangement properties much more complex than these devices)

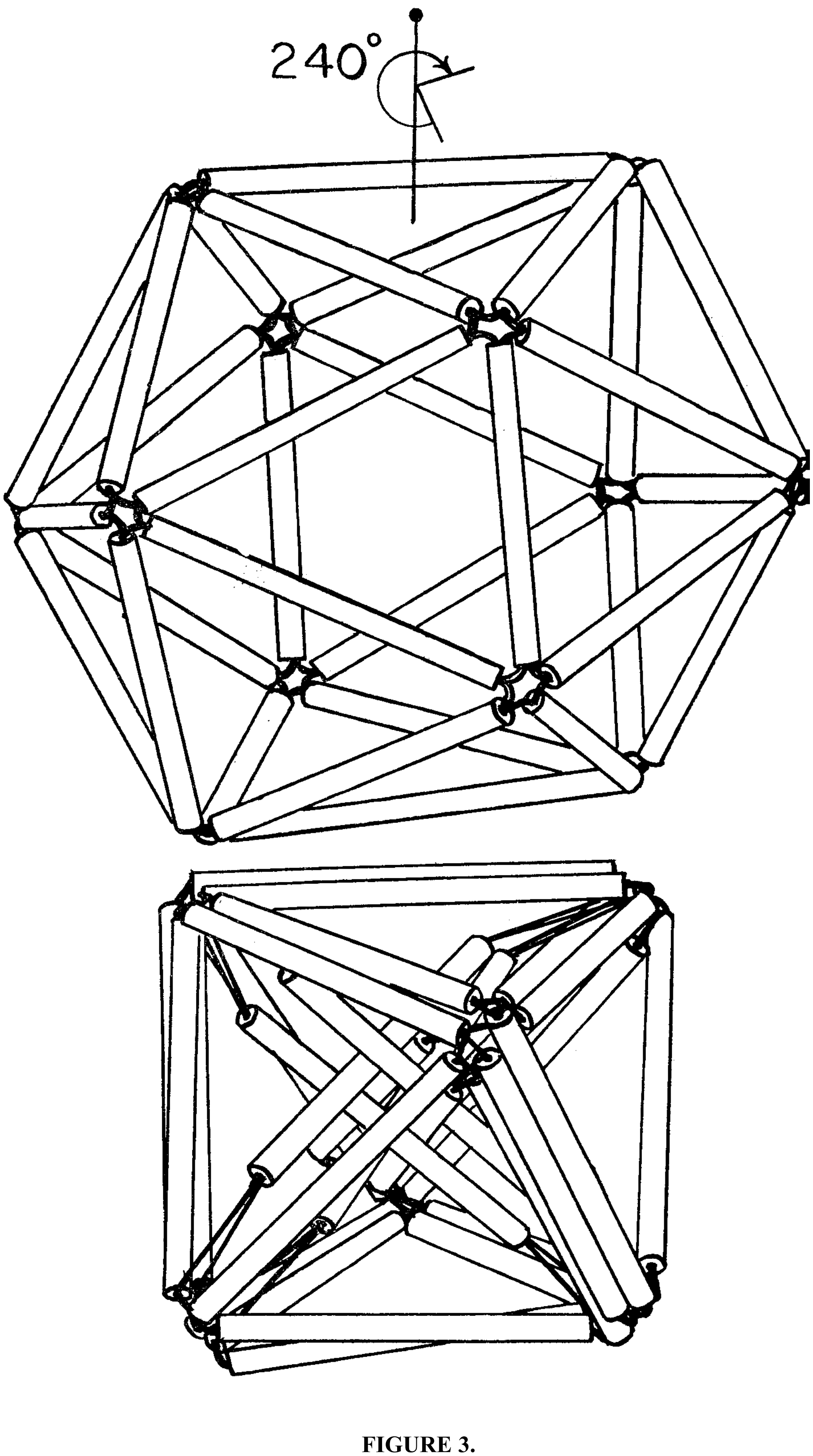


FIGURE 3.