FOOTHOLD TRAP

The design challenge assigned for this year of Davidson's RobotEx company was to design a pyramid that fits entirely within a 24 inch cube and weighs less than 24 pounds. The creativity in this task is left up to the disgrace of the applicant. When studying the possibilities, and considering my love for the biological studies, the design idea chosen for this is a foothold trap.

The research of foothold trap revealed the following:

Probably most commonly associated with trapping, the foothold trap is made up of two jaws, one or two springs, and a trigger in the middle which is usually a round pan. When the animal steps on the trigger the trap closes around the foot, preventing the animal from escaping. Usually some kind of lure is used to position the animal, or the trap is set on an animal trail. Foothold traps set for beaver, mink, river otter, and muskrat are positioned in shallow water along the shores and banks of rivers, lakes and ponds. Sometimes the trap is attached to a weight sunk in deeper water. The animal, when caught by the foot, tries to escape by diving into deep water and drowns. Traditionally, these traps had tightly closing jaws to make sure the animal stayed in place. These traps are made in various sizes from catching weasels to bears. At one time traps for wolves and bears had rounded teeth on the jaws to prevent escape.

Modified traps are now available with offset jaws, or lamination, or both, both of which decrease pressure on the animals legs. Traps are also available with a padded jaw, which has rubber inserts inside the jaws to reduce animal injuries. However these traps are more expensive and not widely employed except by research and conservation experts. A single number 3 foothold trap which has a 6 inch jaw spread and commonly used for trapping beaver and coyote costs about 10 to 15 dollars depending on the make, while a padded jaw or "Soft Catch" trap cost from 12 to 20 dollars. Today's traps are specially designed in different sizes for different sized animals which trappers and trap manufacturers claim also reduces injuries. Anti-fur campaigns have protested leg hold traps on grounds that animals caught in leg hold traps will frequently chew off their leg to escape the trap.

In states that have banned the use of the foothold trap, a number of issues have arisen. In Massachusetts, the beaver population increased from 24,000 in 1996 to over 70,000 beaver in 2001. Coyote attacks on humans rose from 4 to 10 per year, during the five year period following a 1998 ban on leg hold traps in Southern California.

Manufacturers of newer types of traps designed to work only on raccoons claim that these traps are dog-proof. These traps are small, and rely on the raccoon's grasping nature to trigger the trap. They are sold as coon cuffs, bandit busters and egg traps just to name a few.

In order to fit the design criteria and constraints, the product that I designed is a square pyramidal foothold trap. Unfortunately, the unavailability of SolidWorks limited the 3D CAD on the product, however there are drawings of the product attached.

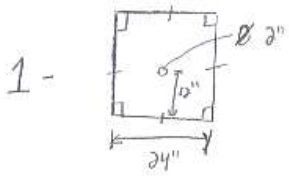
(All safety materials and procedures are assumed to be a personal task)

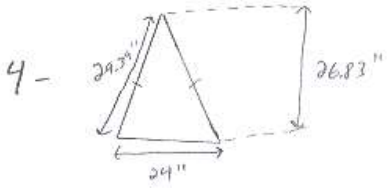
Materials:

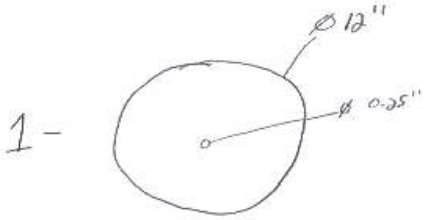
- 12 square feet of 1/2" plywood
- 1 - 2" diameter wooden dowel
- 1 - 1.5" diameter wooden dowel
- 4 - 6" springs
- 4 - 8" segments of Igus Rod
- 4 - Hinges
- 80 specially designed aluminum 'spikes' (1 inch square bases)
- Wood Glue
- Wood and Metal Screws, Bolts (amount may vary)

Procedures:

1. Gather all materials listed above (the specially designed spikes can be made at a metal cutting shop)
2. Begin by using a jig saw to cut out the shapes below from the plywood sheet







3. Using a table saw, cut the 2" diameter dowel to have a 2" height
4. With a 1.5" drill bit and the drill press, drill the middle out of this piece of dowel
5. Also cut a 2" segment of the 1.5" diameter wooden dowel
6. Use both wood glue and wood screws to attach the 2" dowel segment to the center of the base square, making sure that the holes align.
7. Leave that assembly alone for a little while, while you are waiting on the glue to dry, gather the 4 wooden triangles and the aluminum spikes

8. Leaving 0.5" from the outer edge of the triangle, also use wood glue and wood screws to attack the spikes. Ten spikes on each isosceles edge on the side of the triangle that would be on the inside of the pyramid each spike 0.25" apart.
9. Wait approximately 30 minutes for the glue to dry
10. Using the hinges, attach each triangle face to the center of one edge of the base square.
11. Using the metal screws and bolts, attach one end of each spring to the wooden dowel glued to the base, and attach the other end to the lower loose half of the triangles
12. Use wood glue and wood screws to attach the 1.5" diameter wooden dowel to the circular piece of plywood cut earlier (what I call the step assembly)
13. Once the step assembly is dry, create shallow notches on the upper end of the dowel so that the Igus rods can rest in them while the trap is set.
14. The unit itself is now finished! To set the trap continue (A partner would probably be easiest for this step.)
15. Set the stepper unit into the trap, pry back each triangle one at a time and set the Igus rods in place. Once all four are set, the force should be such that the trap is steady until pressure is applied.
16. A rough drawing of the final product as a set trap is as follows: