



Curiosity Guide #502

Simple Machines: Wedge

Accompanies Curious Crew, Season 5, Episode 2 (#502)

Driving Nails

Investigation #5

Description

Let's have some hammering fun!

Materials

- Scrap wood
- Hammer
- Nail
- Machine bolt
- Safety glasses
- Work gloves
- Crowbar

Procedure

- 1) Put on safety glasses and work gloves.
- 2) Lay the scrap wood flat on the table.
- 3) Using the hammer, tap on the machine bolt to try to drive the bolt into the wood.
- 4) Repeat with the nail.
- 5) After several strikes, pull the bolt and nail out with the back end of the hammer or crowbar.
- 6) Examine and compare the holes that were left.
- 7) What do you notice?
- 8) How could a nail be redesigned to make the nail even easier to drive?

My Results

Explanation

The machine bolt has a blunt edge that makes hammering the bolt into the wood difficult. Although the machine bolt leaves a mark, the bolt just crushes the wood fibers and will not hold securely in the wood. The nail, however, is a wedge. Look closely at the end of the nail. You should be able to see 3 or 4 inclined plane edges that form a sharp point. When struck, that sharp point can separate the wood fibers and spread the wood enough so that the nail penetrates the wood. Because there is so much friction against the nail, the nail will hold tightly in place. If the length of the plane, or its taper, were longer, even less force would be needed to get the nail into the wood.

Even though wedges have many purposes, they are most frequently used to separate things. When the crew was using the hammer to drive the nails, the wedge of the nail separated the wood fibers enough to penetrate the wood. The advantage is that the wedge changes the direction of the input force. When we strike down on the hammer, the output force from the shape of the nail causes the wood to move away from the wedge of the nail in every direction. Your zipper does something similar. Watch closely when you unzip your jacket. You can see a small wedge that slides between the teeth of the zipper, so the teeth move aside and open the coat. Wedges are so helpful!

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