

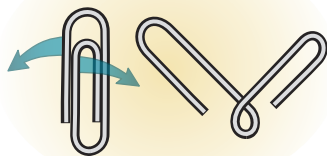
Another FREE SAMPLE LAB from TOPS LEARNING SYSTEMS!

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paper clip pulley

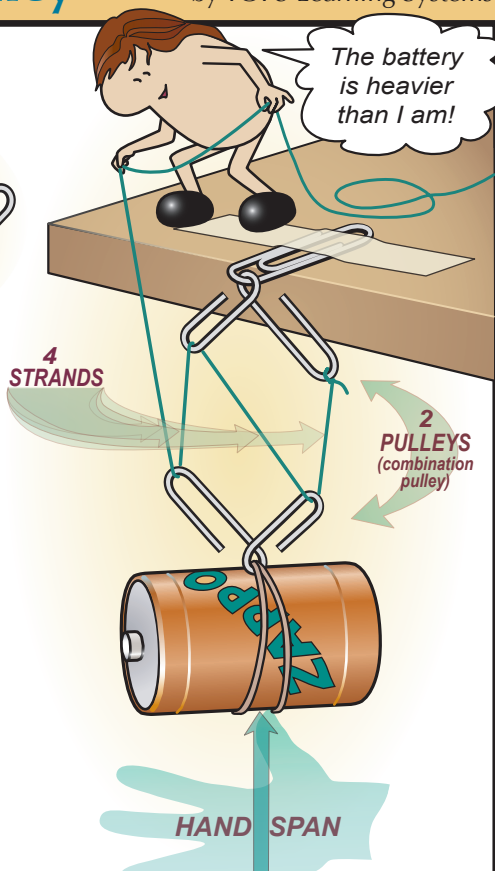
...adapted from **MACHINES #22**
by TOPS Learning Systems

1. Bend 2 paper clips like this:



2. Build a **combination pulley system**, with 4 strands of thread to lift a battery from floor to table.

3. To raise the battery 1 handspan, how far must you raise your hand? Can you feel a force advantage?



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OBJECTIVE

To discover the relationship between force and distance in a combination pulley system.

ANSWERS

Step 3. To raise the battery 1 handspan, you must pull up the thread four handspans. Less force is needed than the weight of the battery. *This system has an ideal weight advantage of 4, not counting friction: 1 lb of force lifts 4 lbs of weight.*

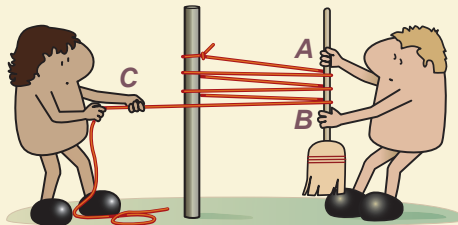
EVALUATION

Q: Loop thread **once** through the lower clip, creating a single movable pulley with 2 strands. (The top clip now has no pulley action.) Lift one handspan. Compare the action of this pulley to the previous system.

A: Lifting the weight a distance of 1 handspan now requires 2 handspans of thread pulling, compared with 4 spans for the original combination pulley. And the battery feels heavier.

EXTENSION

Q: Tie a rope to a strong, smooth post. Wind it around a broom handle and the post as shown. Is this a pulley machine? Who wins the tug-of-war?



A: This is a (combination) pulley machine. The broom acts as the moveable pulley; the post as the fixed pulley. With 6 rope strands between, peoplet **C** must move six times the distance that peoplet **AB** moves. And **C** wins, with six times the force (not counting friction).

MATERIALS

- Three paper clips.
- Scissors.
- Tape (clear or masking).
- Rubber band.
- Dead battery. Larger and heavier (a D cell) is better.
- Thread, about 2.5 meters (8 feet).

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