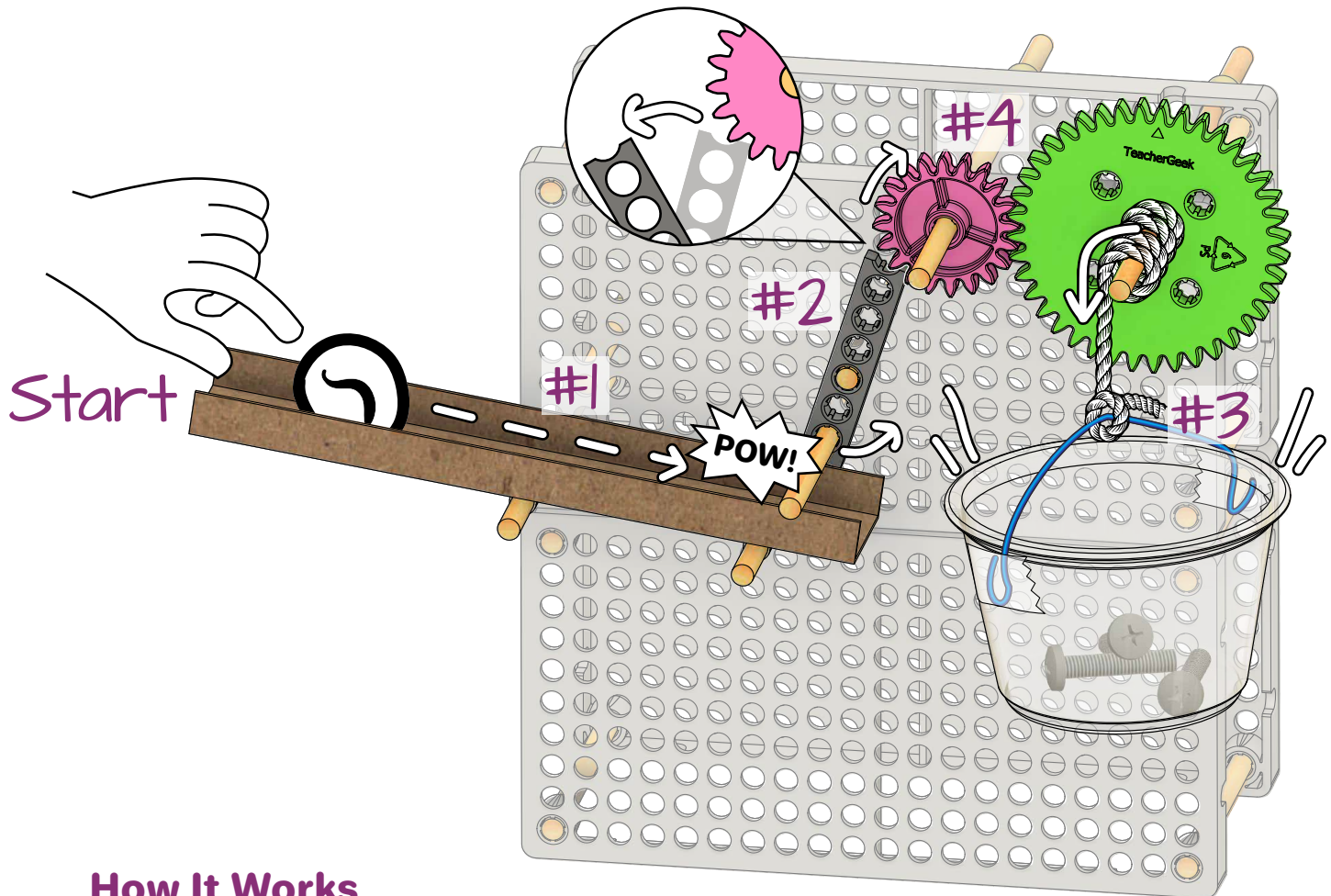


**Build the example contraption,
then evolve it to create your
own unique design!**



How It Works

- Start - Hand drops ball
- #1 - Ball rolls down ramp, hitting lever
- #2 - Lever swings, unlocking gears
- #3 - Bucket falls, turning winch
- #4 - Gears spin



Want to end this activity with a Challenge?

Download the [Chain Reaction Challenge](https://www.teachergeek.com/contraptions)
or the [Story Telling Challenge](https://www.teachergeek.com/contraptions) at
[TeacherGeek.com/Contraptions](https://www.teachergeek.com/contraptions)

CONTRAPTION PARTS

These are the parts you need to build one Contraption, plus some extras, to make your own unique designs!

NAME	QTY	PICTURE
Hole Plates	4	
Strips	4	
Blocks	6	
Gear Set	1 set (4 gears)	
Wire 5 m (16 ft)	1	
Portion Cup	1	
Rubber Bands	4	
Slide Stop 8 cm (3 in)	2	
Screws 25 mm (1 in)	5	
String 90 cm (36 in)	1	
Chipboard 22 cm x 5 cm (8.5 in x 2 in)	4	
Bouncy Ball or Marble	1	
Dowels various sizes	12 - 8 cm (3 in) 6 - 10 cm (4 in) 6 - 13 cm (5 in) 6 - 15 cm (6 in) 4 - 30 cm (12 in)	

MATERIALS YOU SUPPLY

- Scissors
- Phillips Screwdriver
- Tape
- Recycling Bin Materials (optional - to incorporate into your designs)



Optional Tools



Modify materials to make even more creative designs with the **Maker Tool Set** SKU 1823-84

Using a Maker Cart?

You'll need to supply your own bouncy ball.

Kids will need about 10 full length dowels (30 cm/12 in), if you aren't precutting dowels.



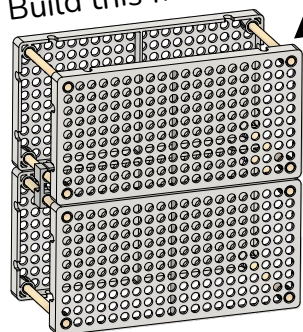
Did you print this yourself? The ruler is only accurate if you printed at 100% scale.

Make Your Frame



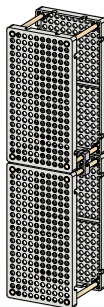
Your contraption's frame will hold all the machines.

Build this frame first.

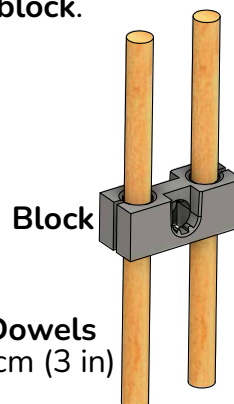


Swing

You can transform your frame when you make your own unique contraption!



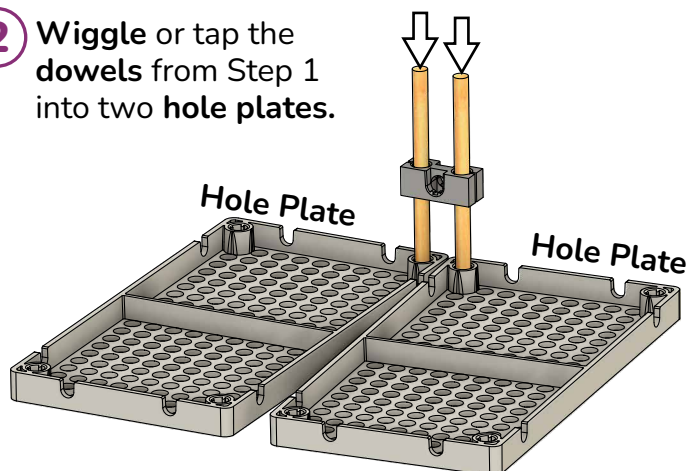
- 1 Your 1st challenge: Wiggle or tap two 8 cm (3 in) dowels into a block.



Block

Dowels
8 cm (3 in)

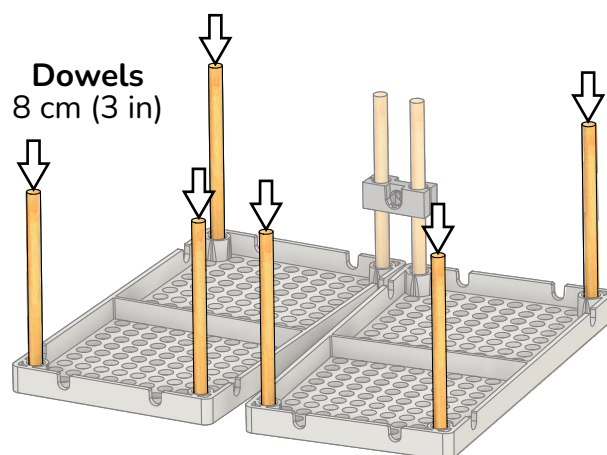
- 2 Wiggle or tap the dowels from Step 1 into two hole plates.



Hole Plate

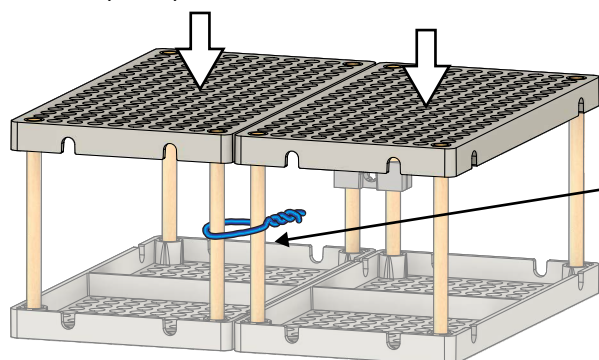
Hole Plate

- 3 Add six more 8 cm (3 in) dowels to the corners of the hole plates.

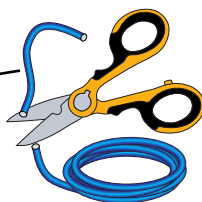


Dowels
8 cm (3 in)

- 4 Add two more hole plates to the top of your dowels.



- 5 Lock your frame by twisting a piece of wire around the dowels.

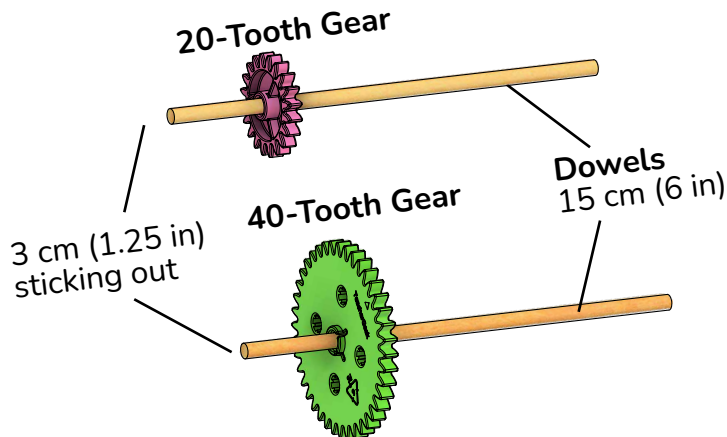


✓ Your frame is done!
Time to add gears.

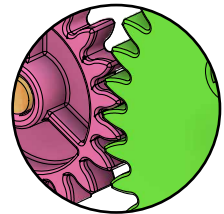
Add Gears

Gears transfer motion, trading between **speed and torque** (turning force).

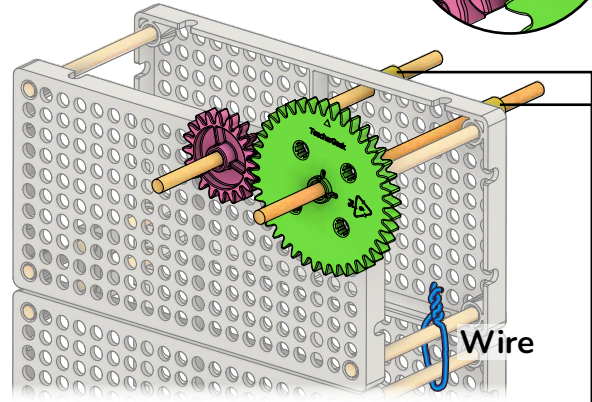
- 6** Wiggle or tap gears onto dowels to make the gears below.



Meshed Gears



- 7** Mesh the gears near the top right of your frame.

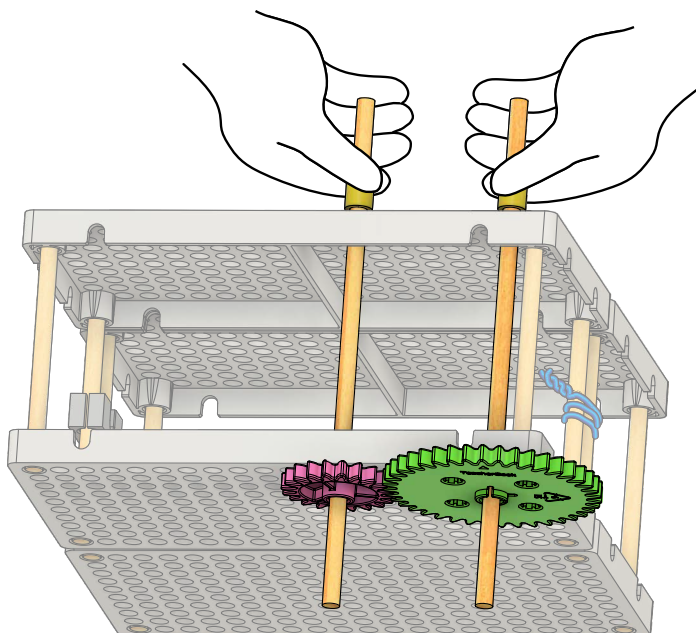


- 8** Add slide stop to the back of the dowels so the gears don't fall off.



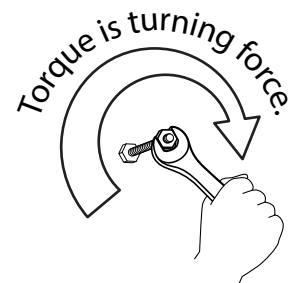
Playtime!

Which gear increases torque? Which increases distance?



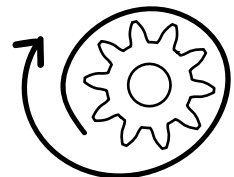
Feel the Torque

Have a twisting war! Twist both dowels at the same time; the one that's easier to turn has more torque.



See the Distance

Turn the gears one at a time. Which gear do you turn to make the other gear turn more times?



Want to learn more about gears?

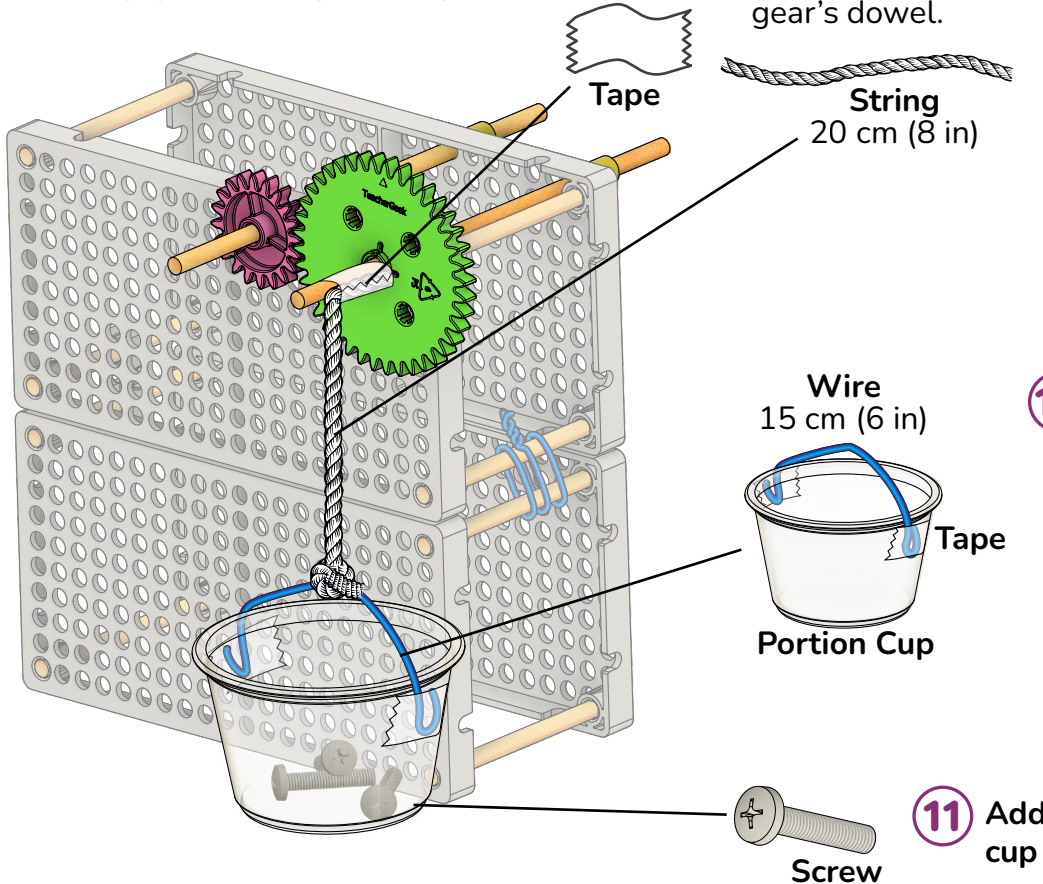
Download the [Gears Mechanical Advantage Sheet](https://www.teachergeek.com/Contraptions) at [TeacherGeek.com/Contraptions](https://www.teachergeek.com/Contraptions)

☒ **Your gears are done!** Time to connect a winch.

Add a Winch



Your winch will turn the big gear using a weight.



What's a Winch?



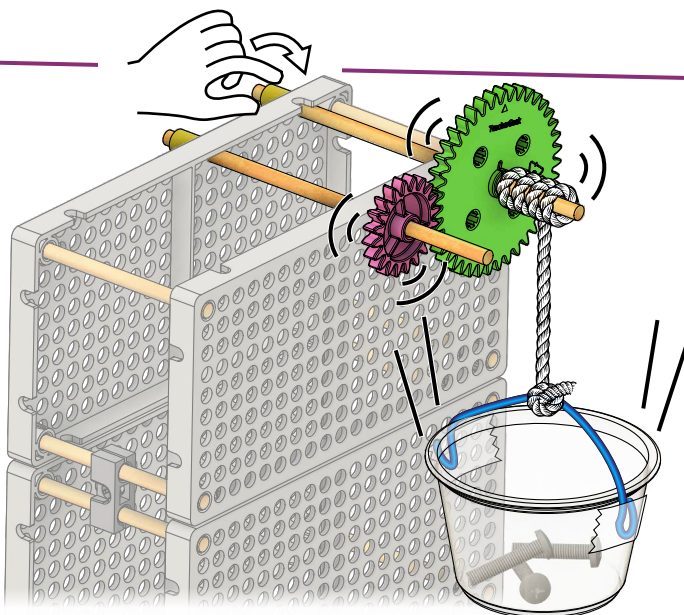
Old water wells use winches to raise and lower the bucket.

- 10** Tape a 15 cm (6 in) piece of wire to the portion cup, then tie it to the string.



Cut wire with scissors.

- 11** Add three screws to the cup to use as weights.



Playtime!

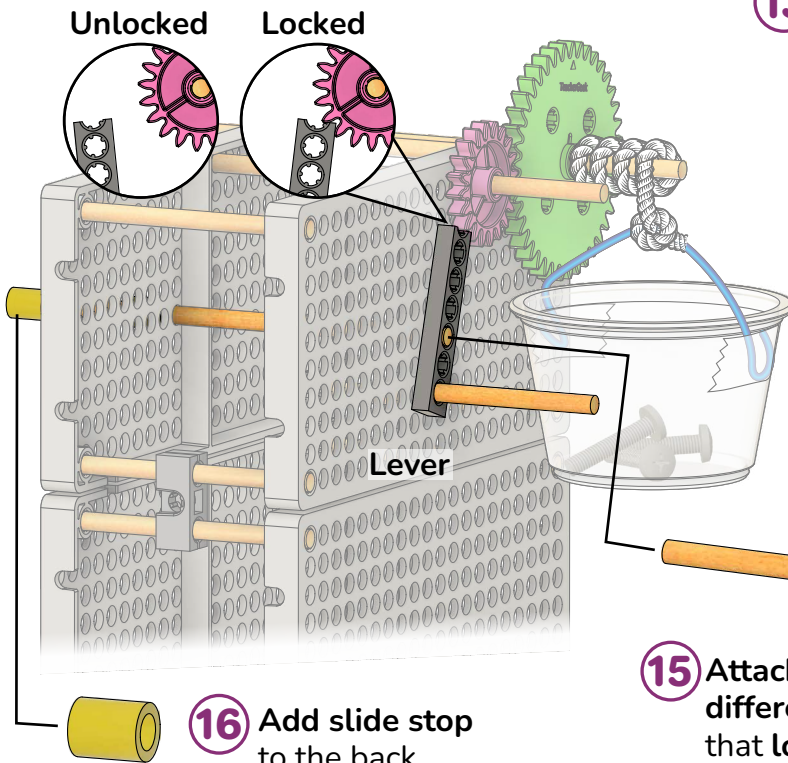
- 12** Turn the dowel to wind up the winch.

Then let it loose!

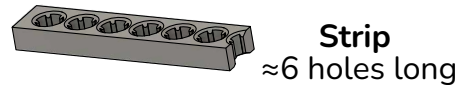
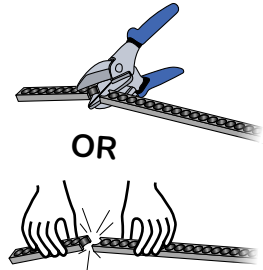
- ✓ **Your winch is done!**
Time to add a lever.

Add a Lever

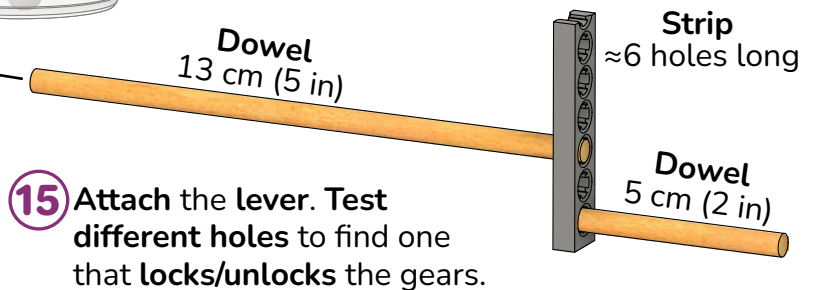
Your lever locks and unlocks your gears.



- 13 Cut or snap a strip so it's about 6 holes long.



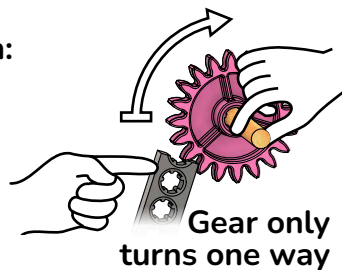
- 14 Tap or wiggle the dowels into your strip to make your lever.



- 15 Attach the lever. Test different holes to find one that locks/unlocks the gears.

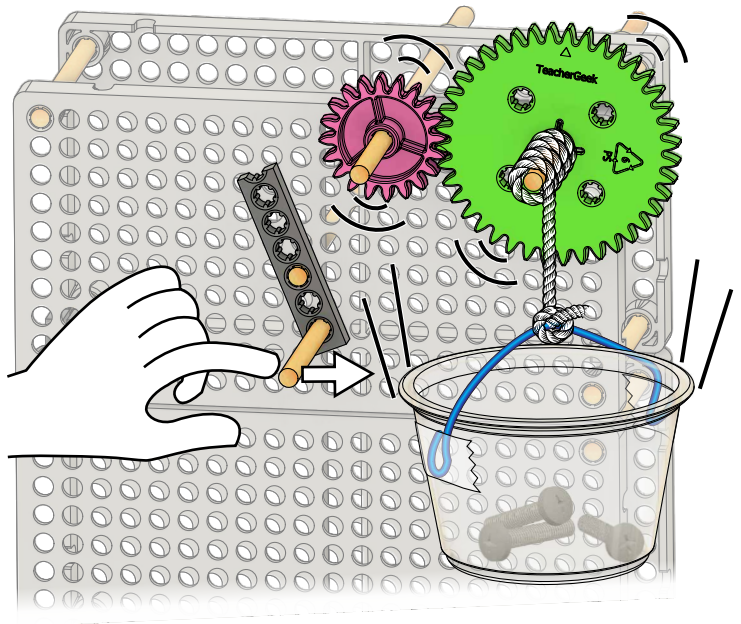
Playtime!

- 17 Wind up your winch: turn the gear while pushing the lever into it.



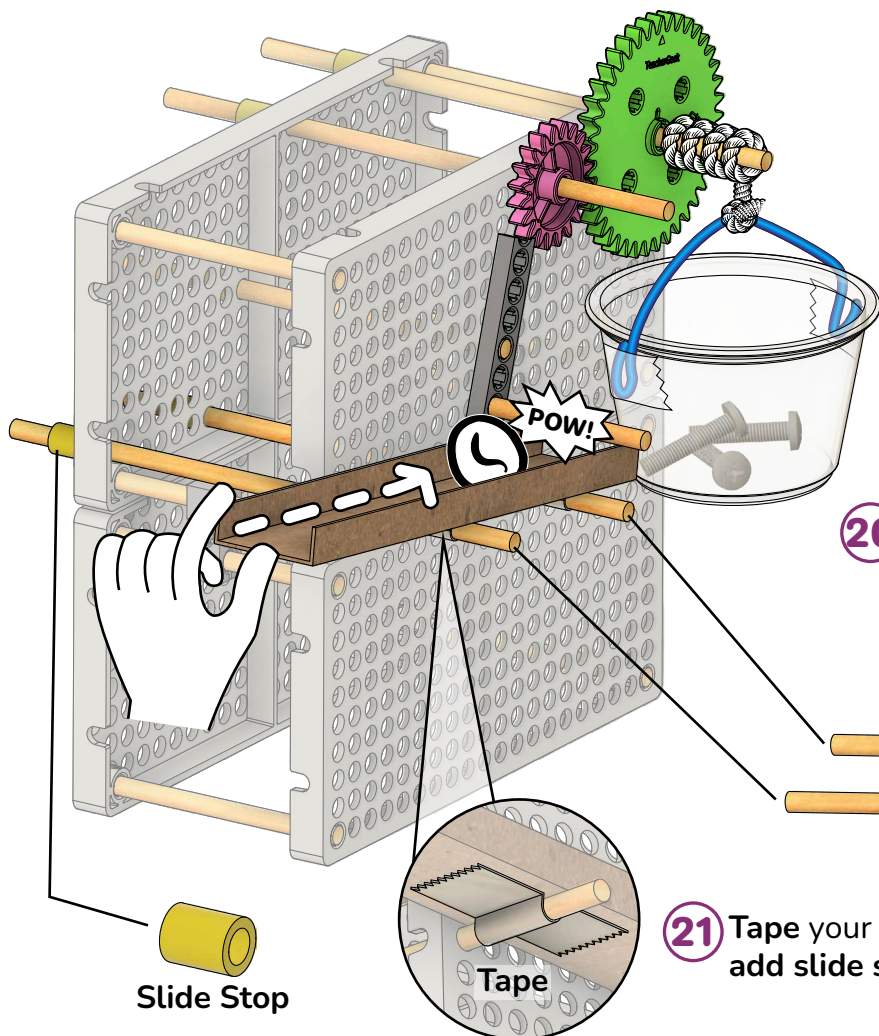
- 18 Then push the lever to release it!

✓ Your lever is done! Next, you'll add an inclined plane.

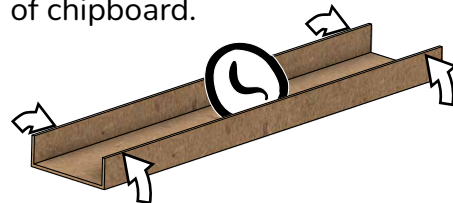


Add an Inclined Plane

Roll marbles down your inclined plane (ramp) to push your lever!



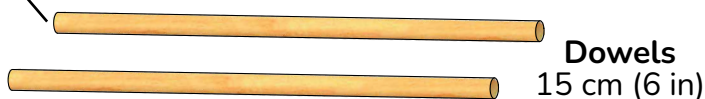
- 19** Make a ramp by folding a piece of chipboard.



Using A Maker Cart?

Cut your chipboard to $\approx 5 \text{ cm} \times 22 \text{ cm}$ (2 in x 8.5 in) before folding.

- 20** Position your ramp so the ball will roll into the lever, then **slide two 15 cm (6 in) dowels** under it to hold it in position.



- 21** Tape your ramp to your dowels, then add slide stop to hold it in place.

Congratulations!

Your Example Contraption is done! It's time to start the challenge and create your own unique designs!

Optional Challenges:

Chain Reaction Challenge

Chain together as many machines as you can!

Story-Telling Challenge

Use your contraption to tell a story!

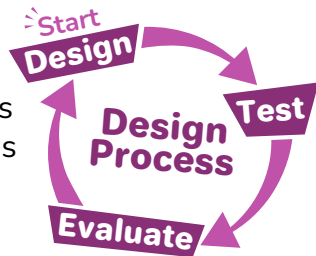


Download documents and videos for this activity at [TeacherGeek.com/Contraptions](https://www.teachergeek.com/contraptions)

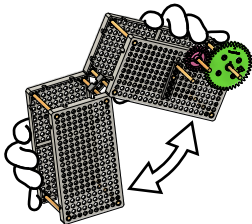
Customize Your Contraption

These are just some ideas to get you started... Follow the design process to create your own unique designs!

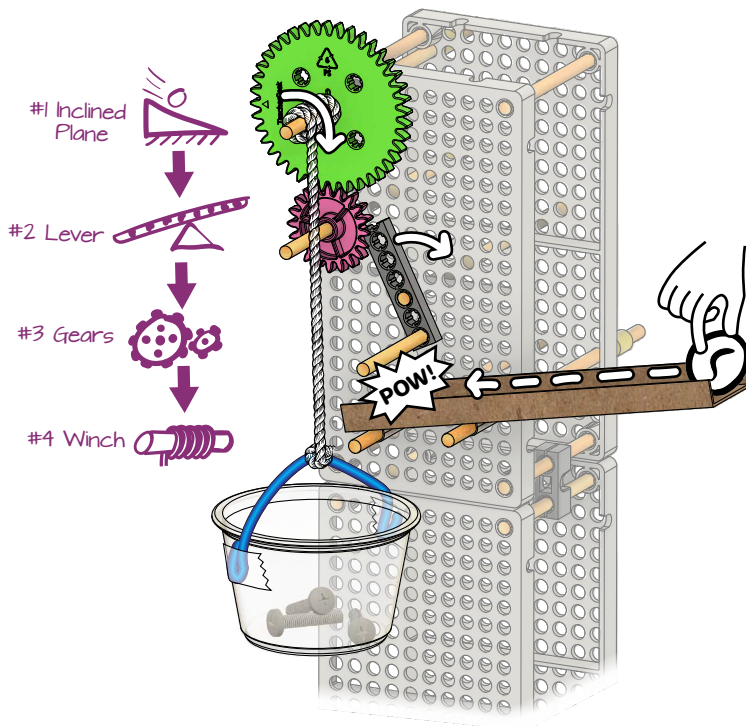
The Design Process never ends! There is no perfect design.



Bend the Frame

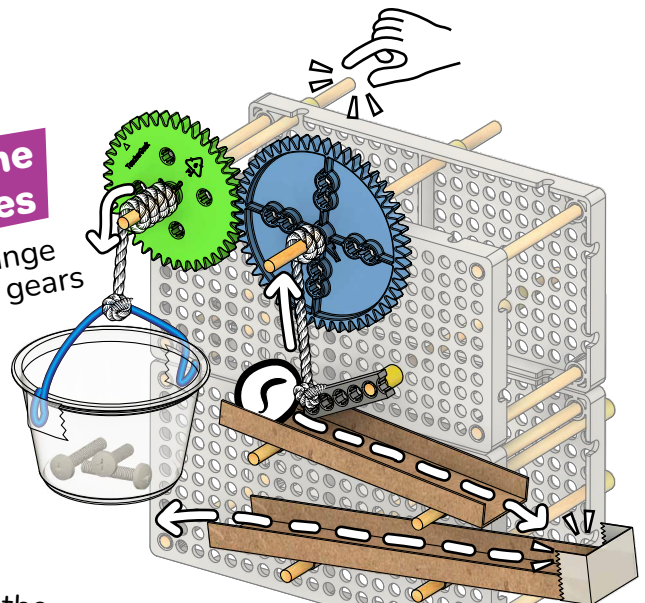


Just bend your frame and move the ramp to transform your example build into this one!



Modify the Machines

Change the gears



Change the sequence



Add more machines!

Go Crazy!

Think outside the box and make something totally unique!

