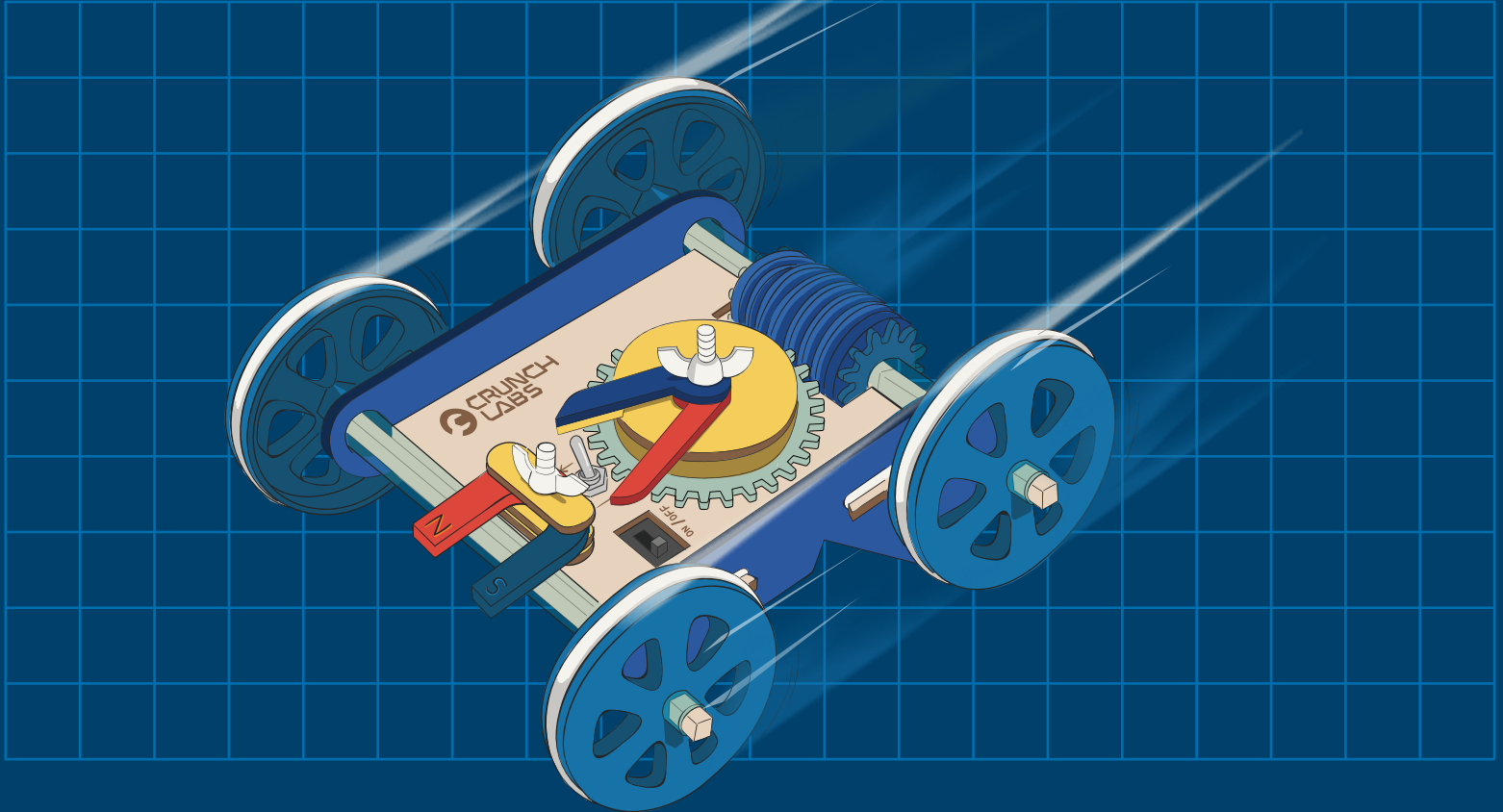




BUILD  
BOX



# BOOMERANG CAR



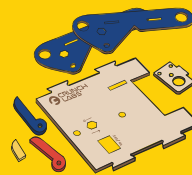
# NEW VIDEO UNLOCKED

BUILD ALONG & LEARN WITH MARK ROBER

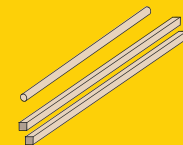


[CRUNCHLABS.COM/AUTO](https://crunchlabs.com/auto)

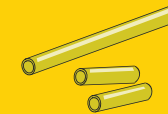
## PARTS



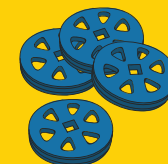
wood pieces



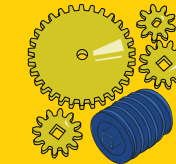
dowels



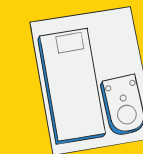
plastic tubes



wheels



gears



adhesive foam



rivets



wing nuts



bolts



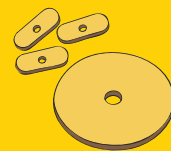
silicone tubes



o-rings



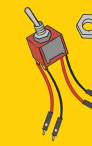
foam spacer



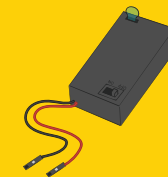
yellow panels



geared dc motor



on/on switch



battery pack

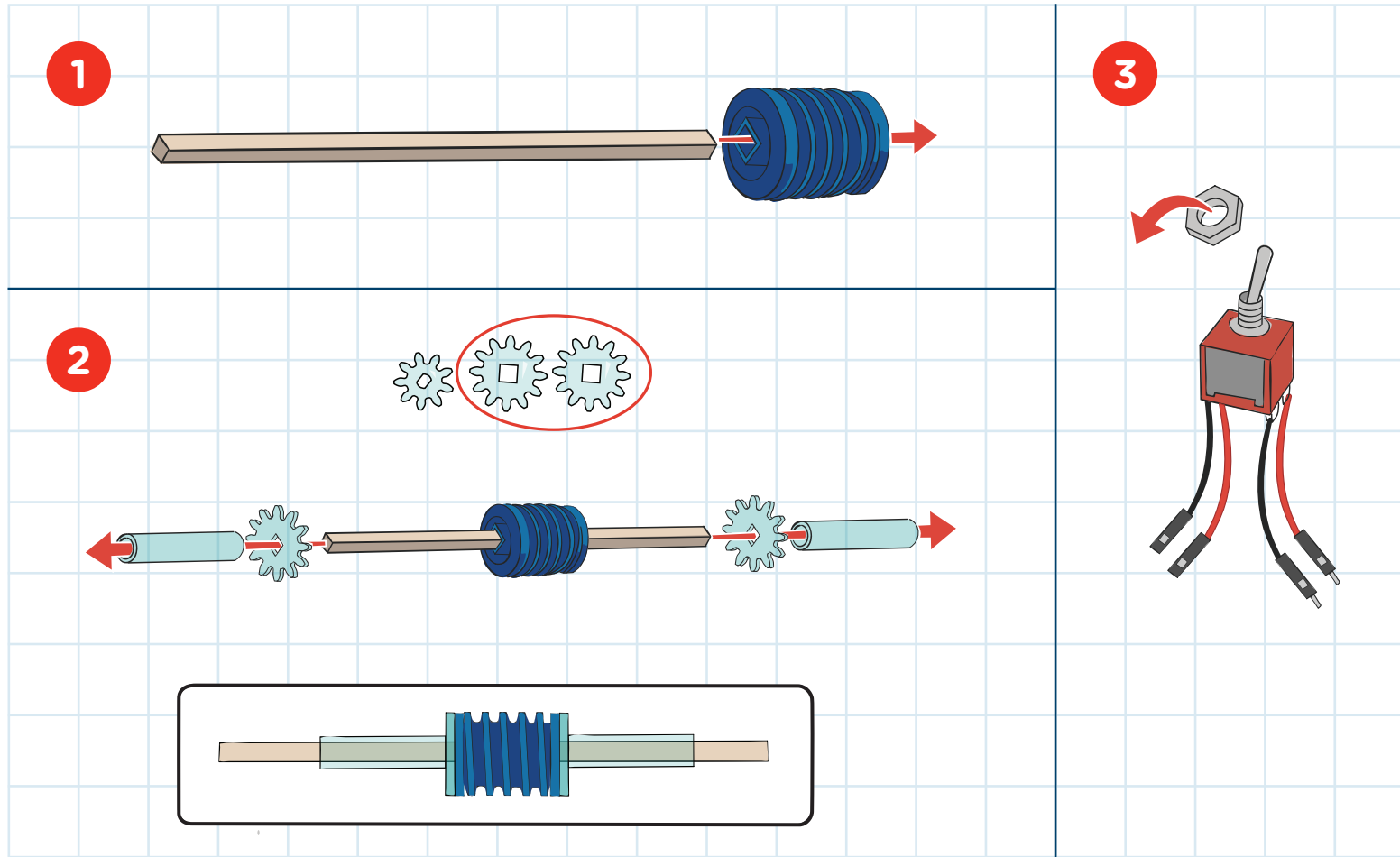


magnet

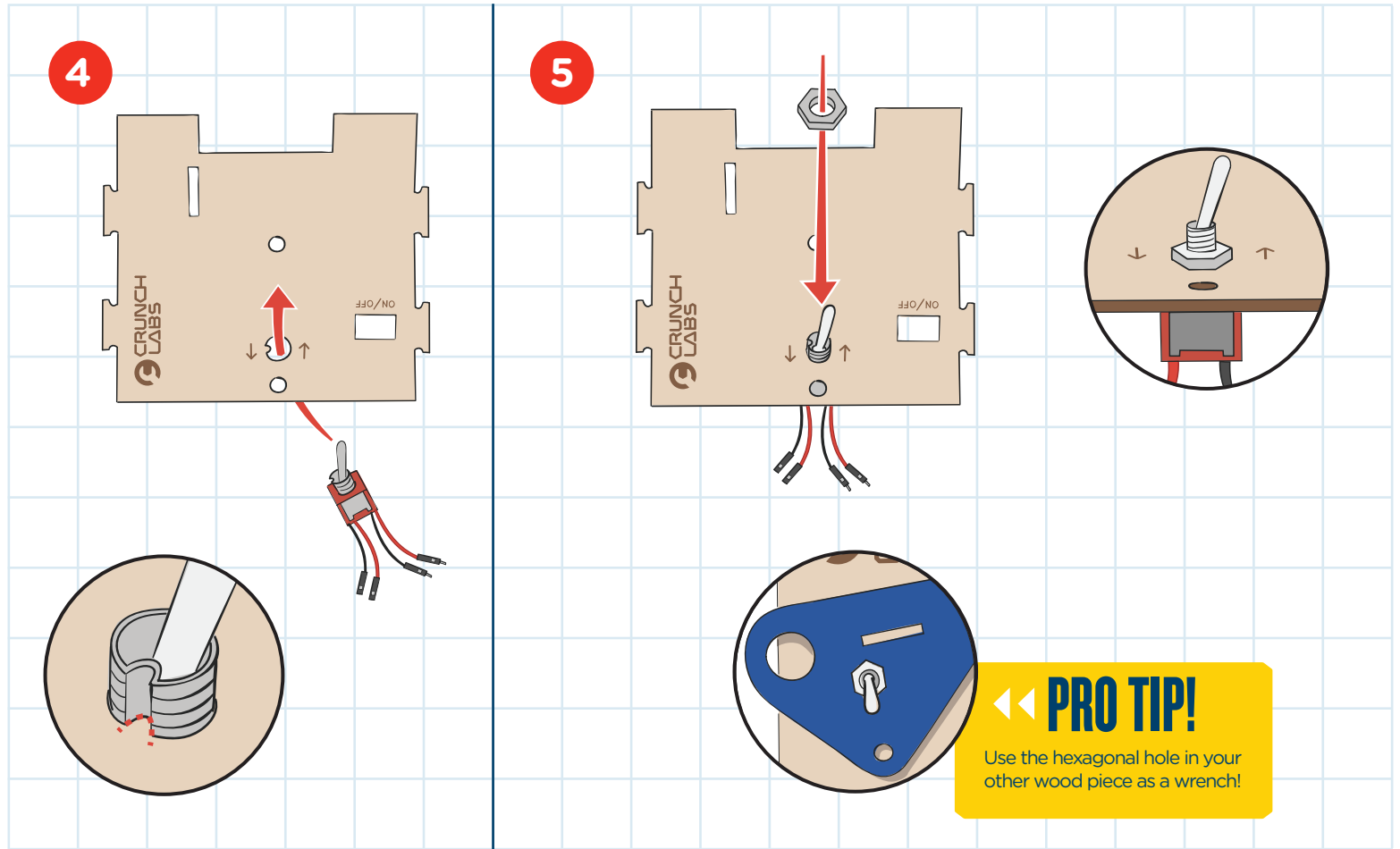


metal cup

# BUILD

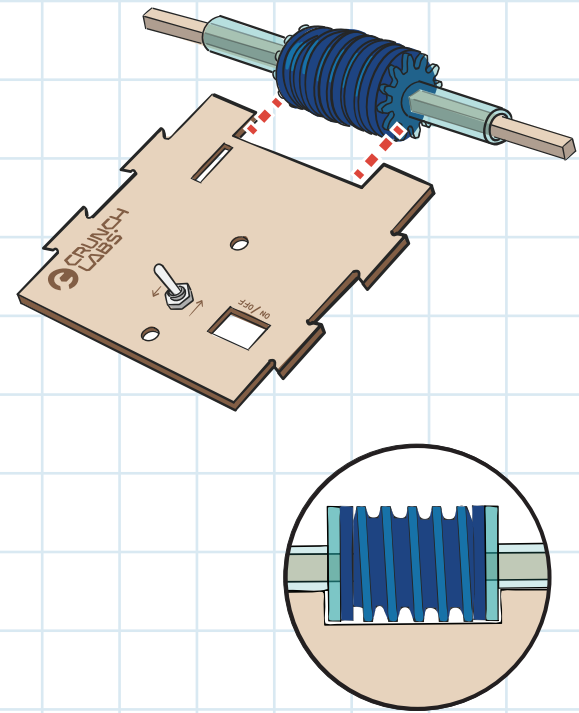


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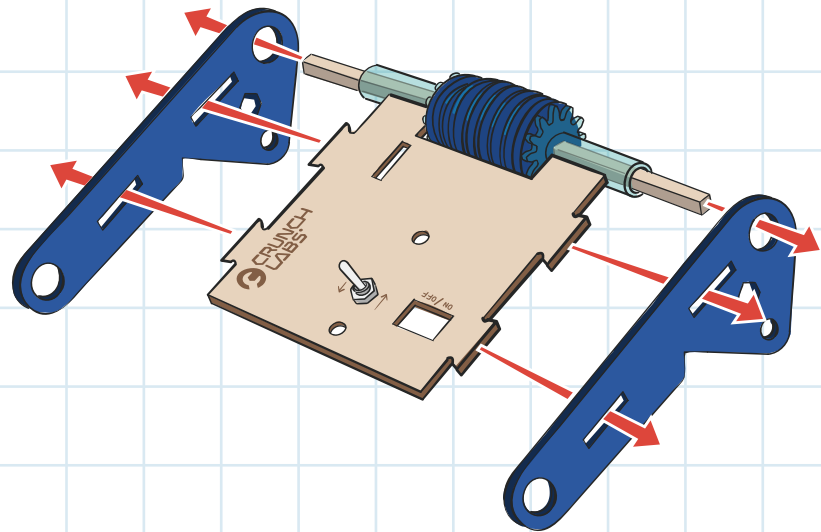


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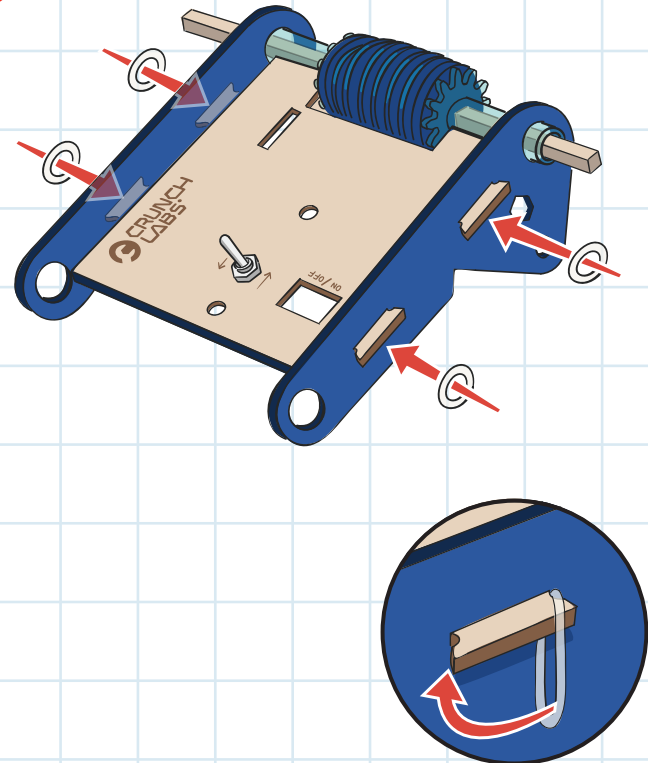
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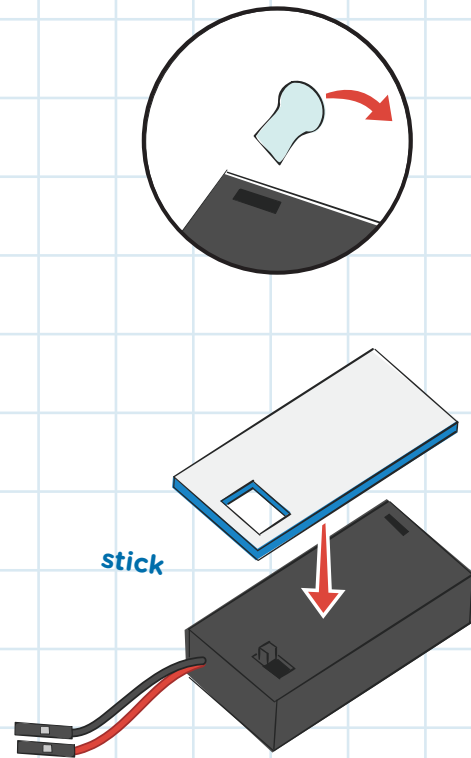
7



8

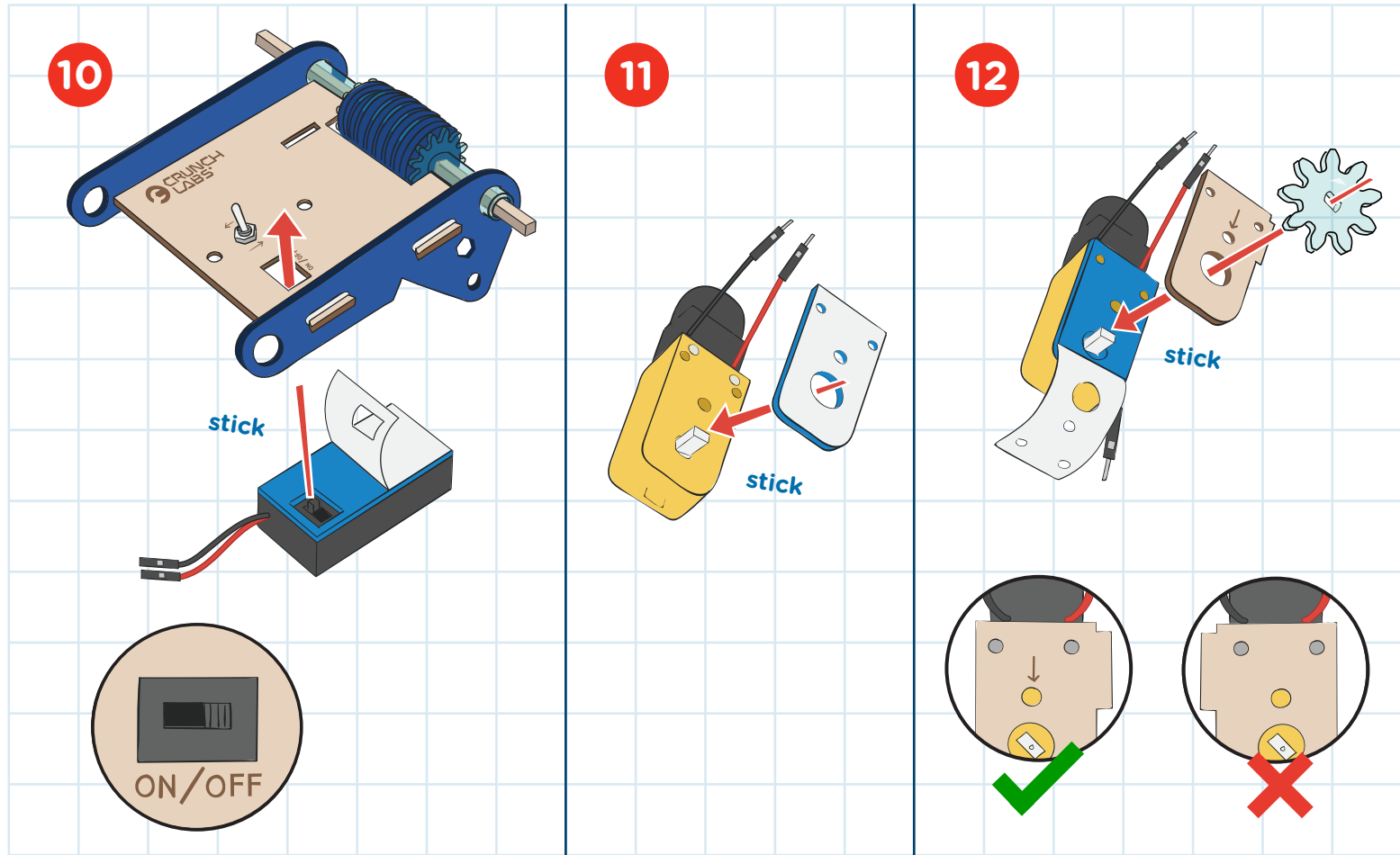


9

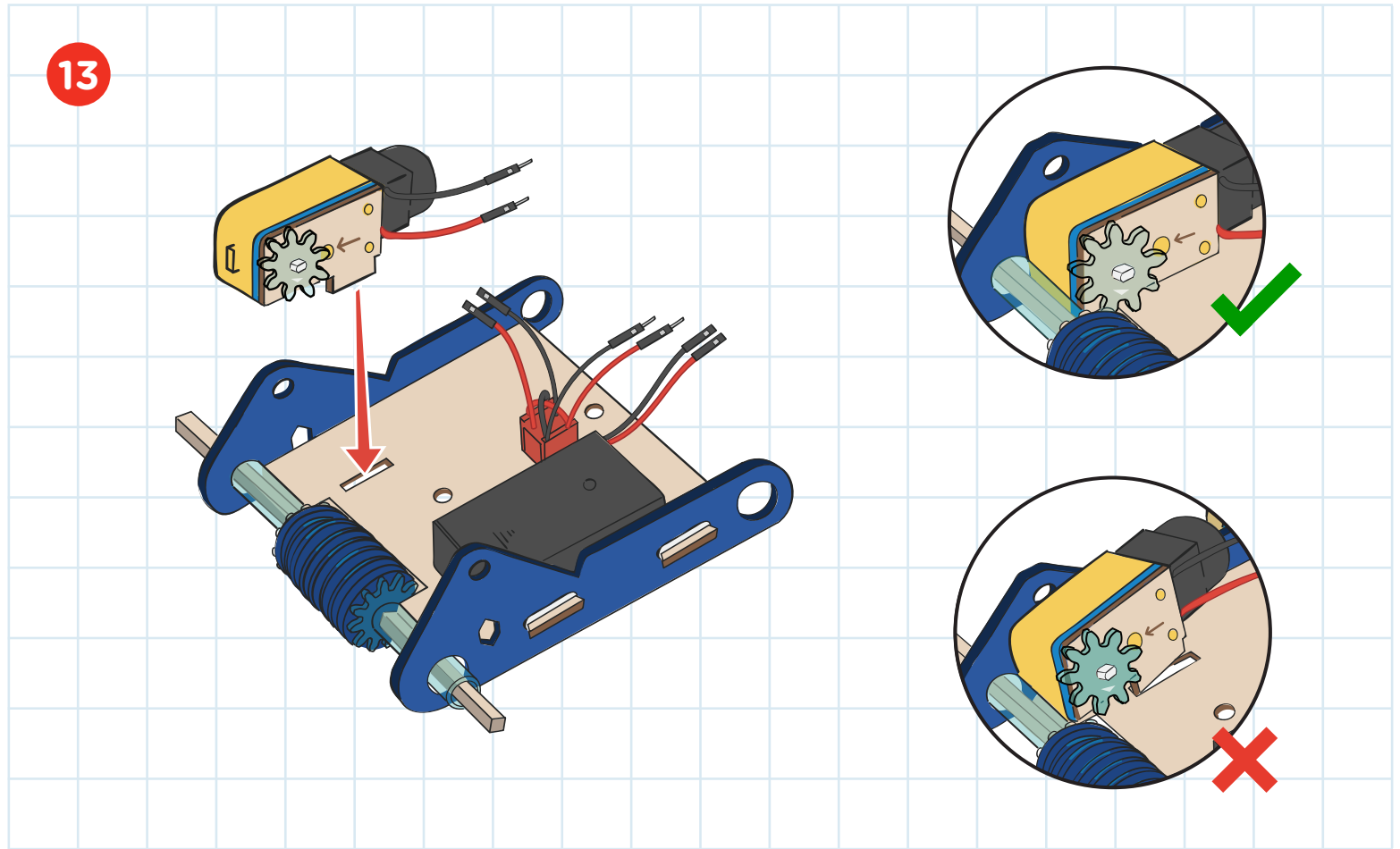


# BUILD

# BUILD

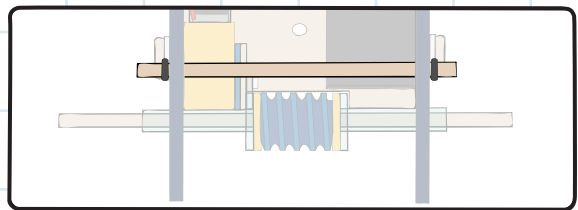
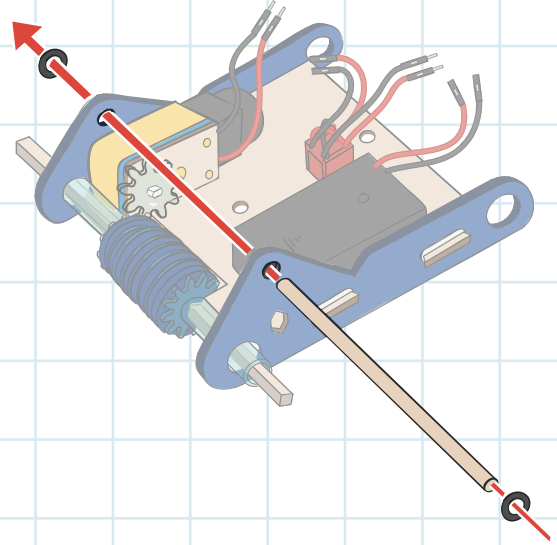


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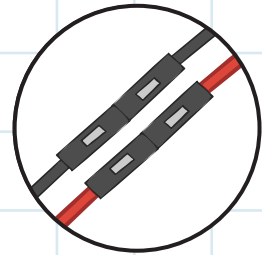
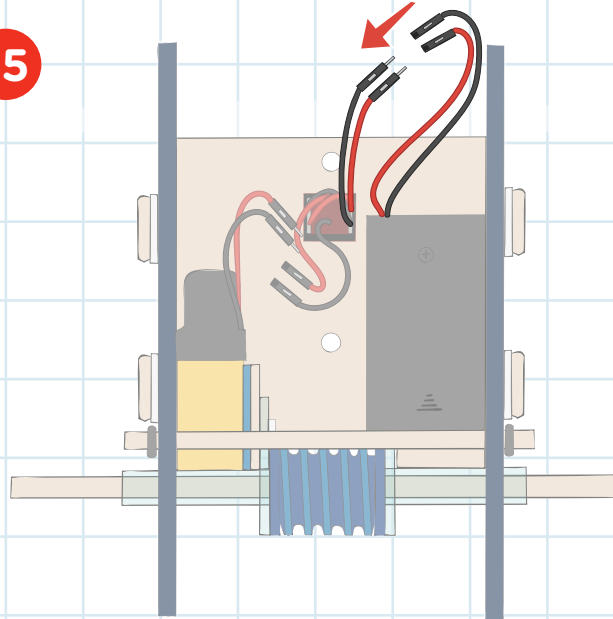


# BUILD

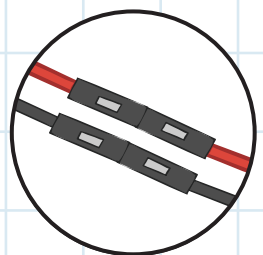
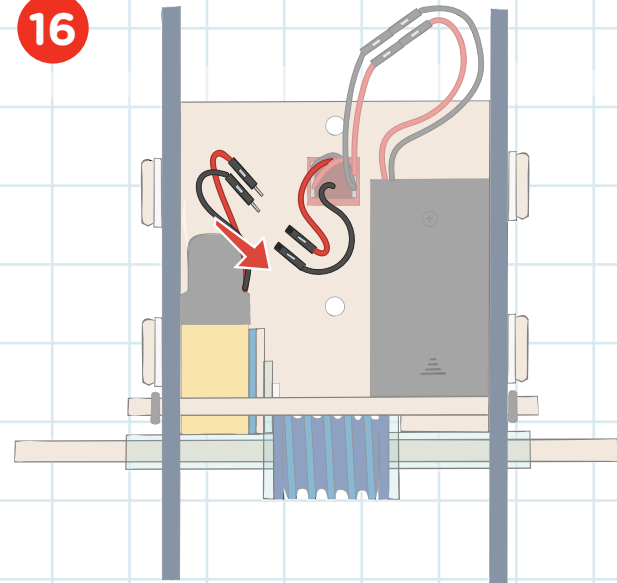
14



15

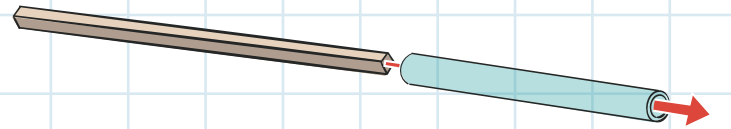


16

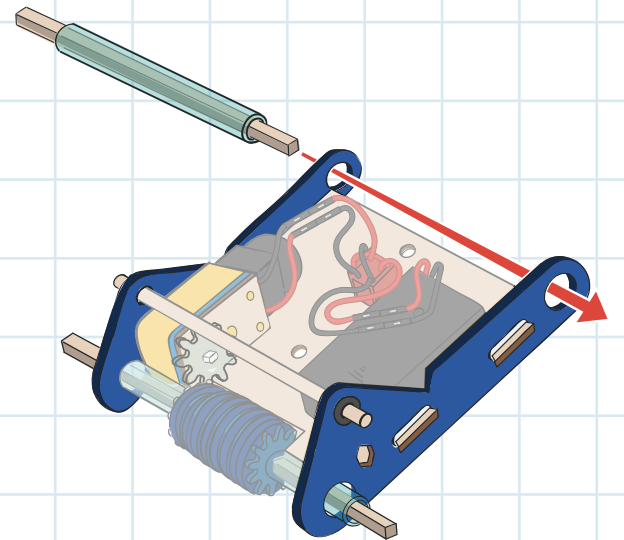


# BUILD

17

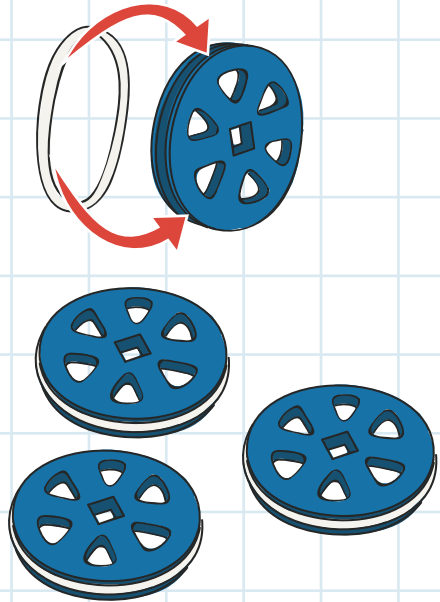


18

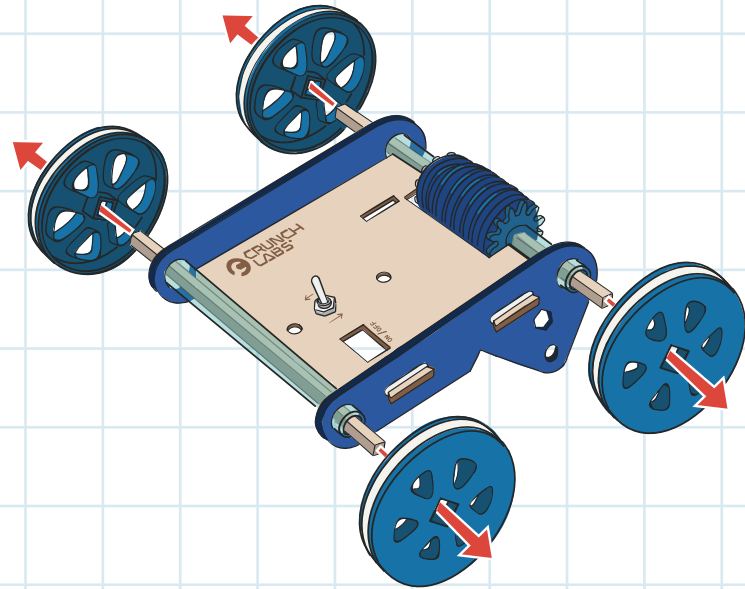


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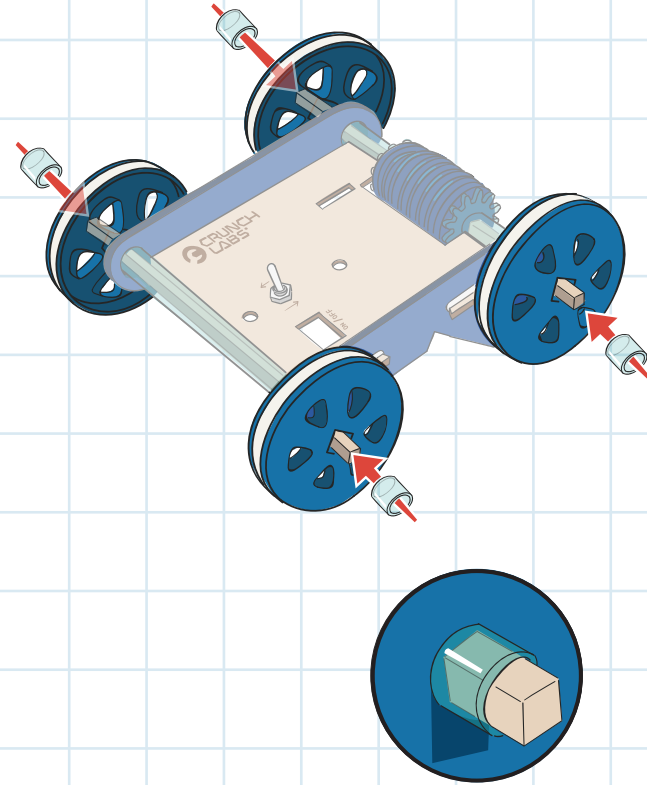
19



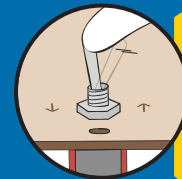
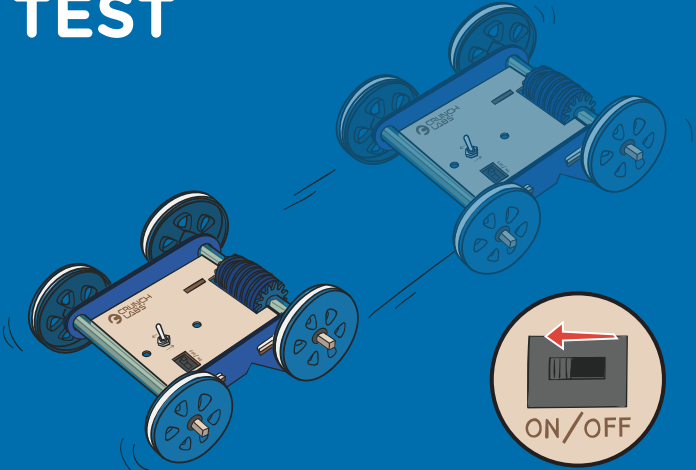
20



21



# TEST



## PRO TIP!

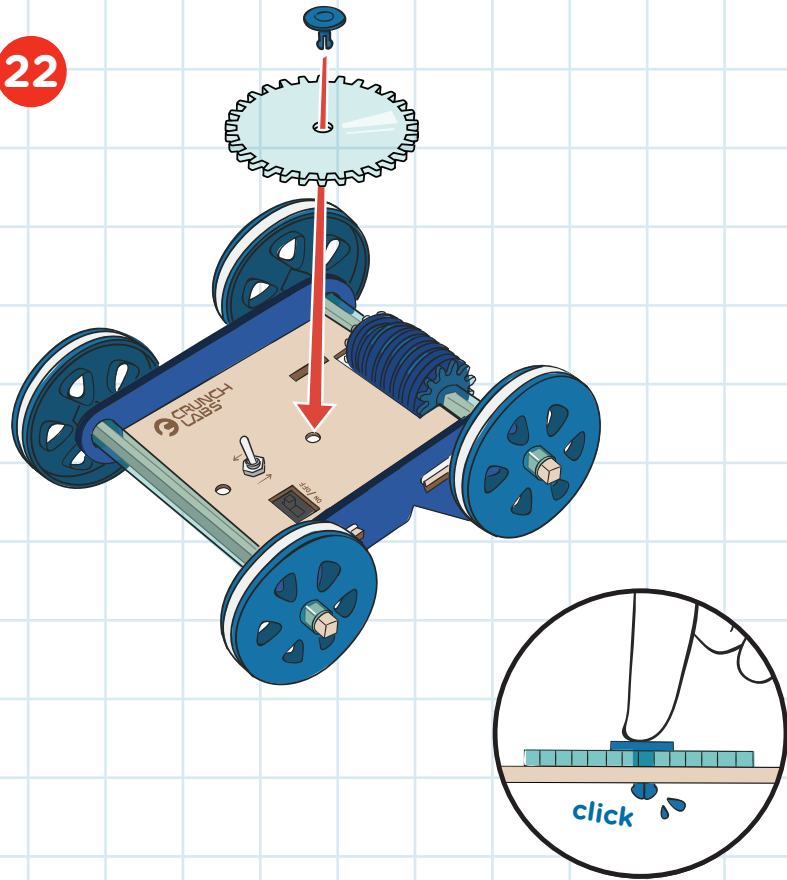
An **ON/ON** switch allows power to flow in either direction. There's no "off".

Having trouble? Watch the video at [crunchlabs.com/auto](http://crunchlabs.com/auto)



# BUILD

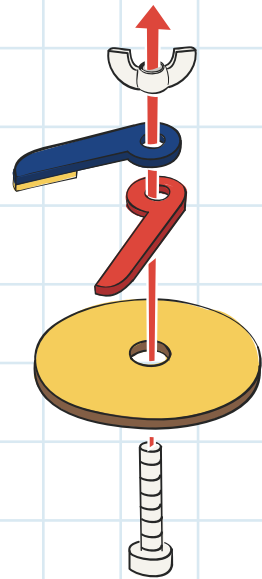
22



23

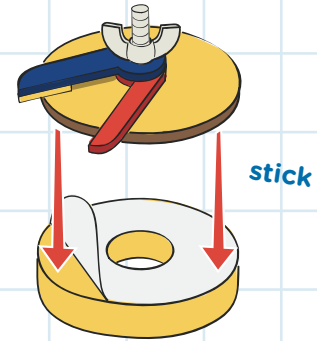


24

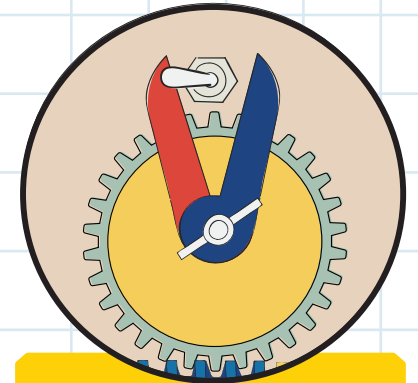
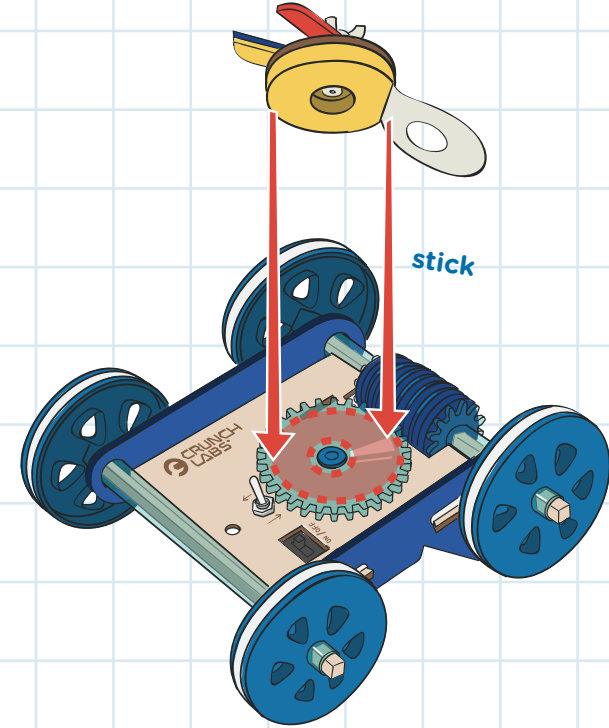


# BUILD

25



26

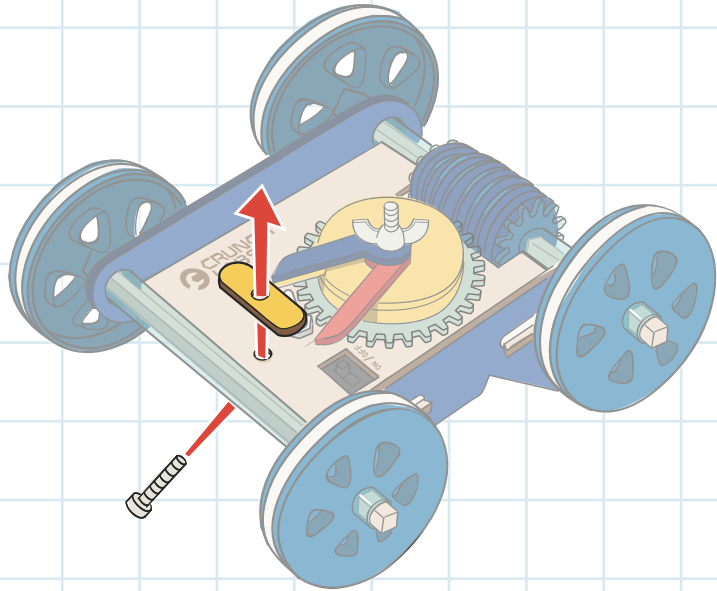


**PRO TIP!** ▲  
A **limit switch** makes sure a machine doesn't go too far. These arms allow you to adjust how far your car goes before changing direction.

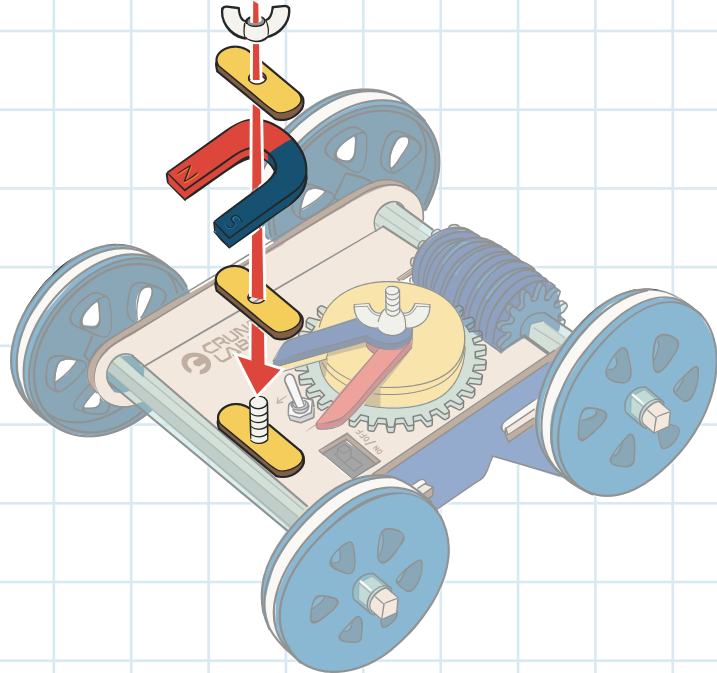


# BUILD

27

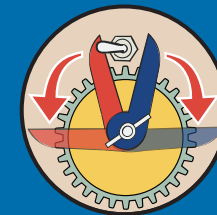
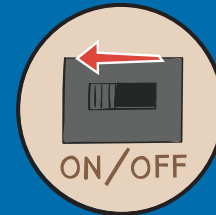
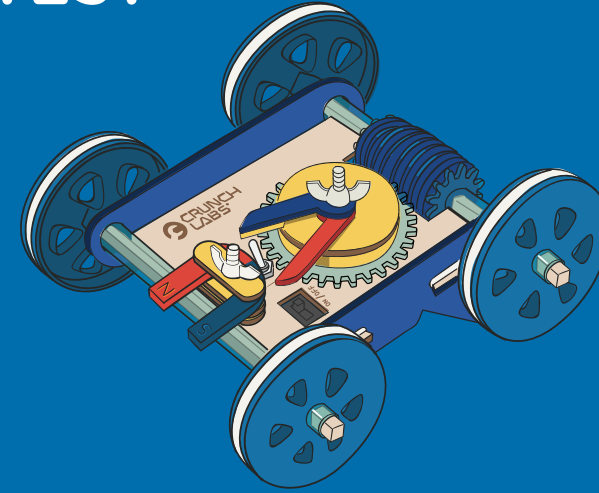


28



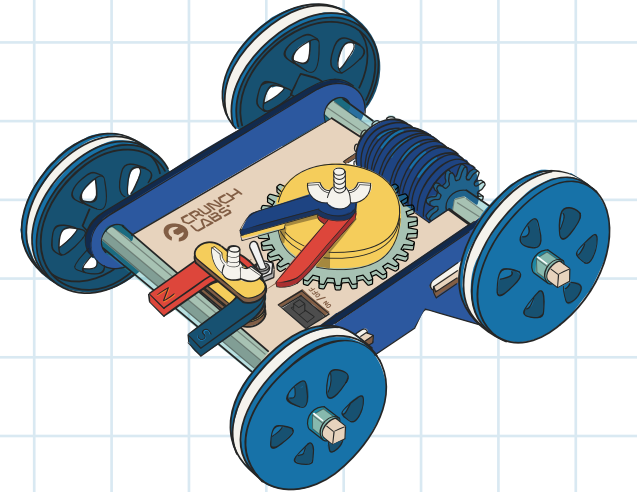
# BUILD

## TEST



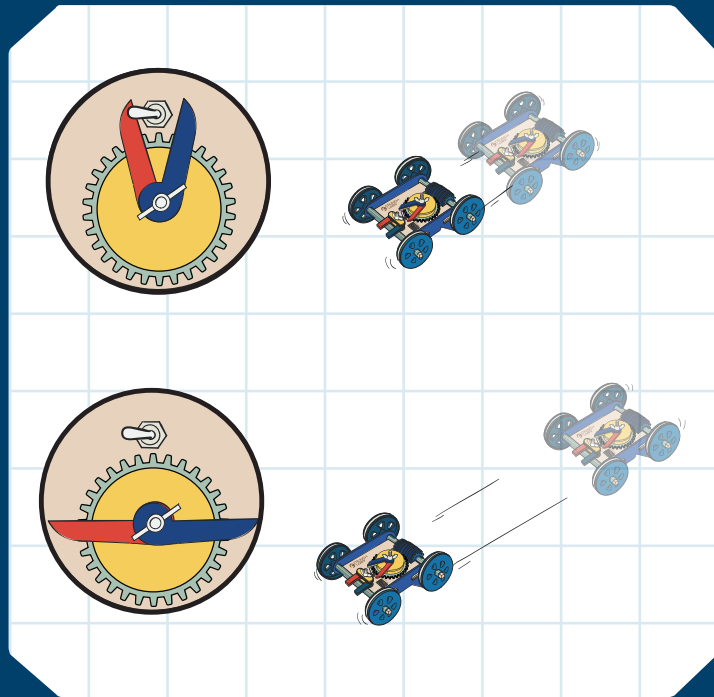
Having trouble? Watch the video at [crunchlabs.com/auto](http://crunchlabs.com/auto)

BUILT!



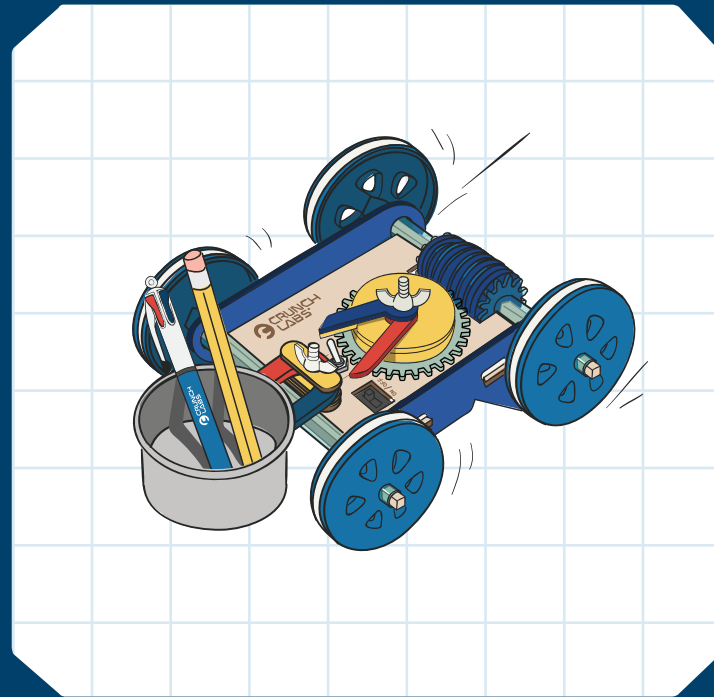
## ADJUSTING ARMS

To change how far the car travels, change the position of the arms.



## DELIVERY TIME

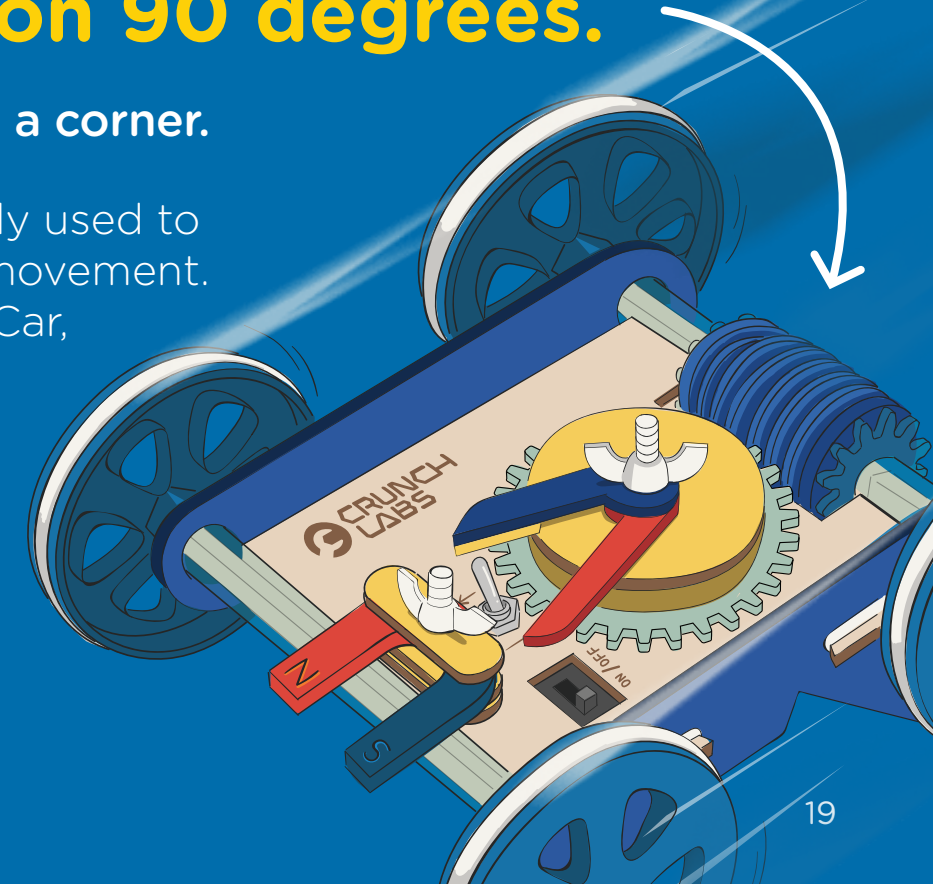
Point the car's magnet at the tin, and try to retrieve it.



A **worm drive** is a gear that changes the axis of rotation 90 degrees.

Basically, it's a gear that turns a corner.

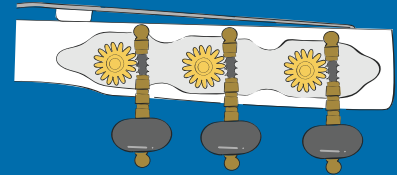
**Worm drives** are most commonly used to change the orientation of gear movement. Take a look at your Boomerang Car, and you will notice that it uses a **worm drive** to flip vertical rotation from the motor into horizontal rotation of the red and blue limit switch. Thanks to the **worm gear**, the Boomerang Car's motor, wheels, and limit switch all move together.



THINK

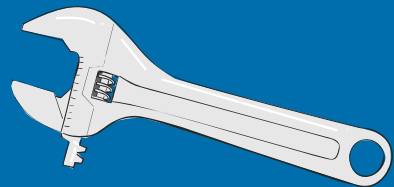
## Find worm drives in other machines!

Unlike other gear trains, worm drives can only be driven from one side. The threads can rotate the gear, but the gear can't rotate the threads. Some machines use worm drives when you need to make an adjustment that will stay locked in place. Normal gears might turn under pressure, but worm drives allow for **small** and **sturdy** adjustments.



### GUITAR TUNER

In order for a guitar to sound right, the tightness of the strings needs to be adjusted. Worm drives **prevent** the strings from loosening themselves.



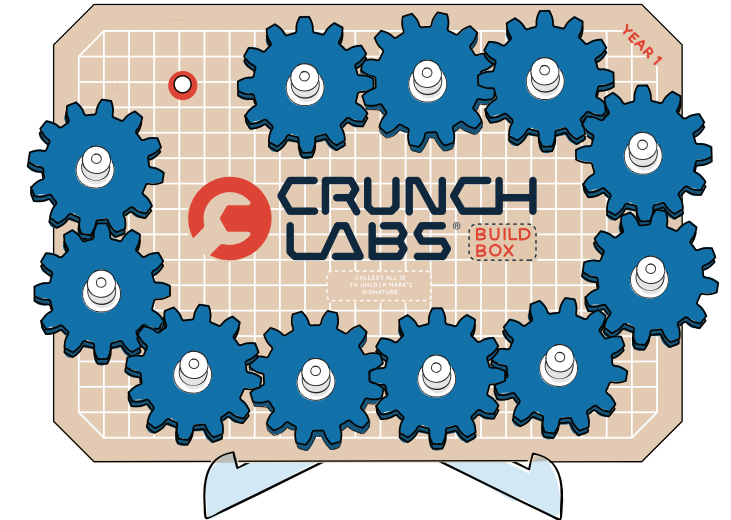
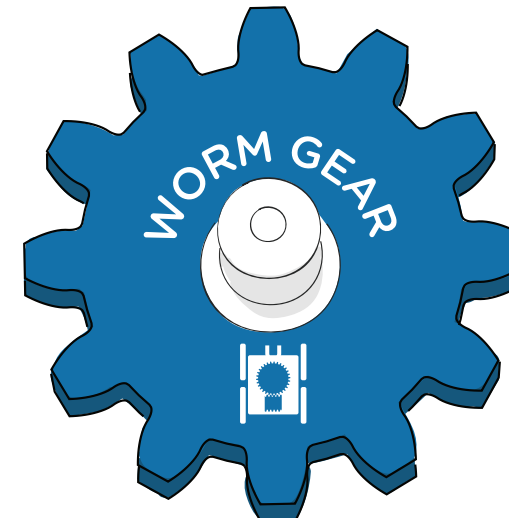
### ADJUSTABLE WRENCH

Adjustable wrenches use worm drives to open or close the clamp of the wrench. That way, the same tool can grab a ton of **different sizes** of nuts or bolts.

THINK

# CONGRATULATIONS!

You earned a gear badge for worm drives

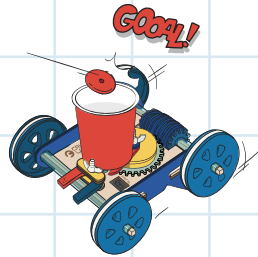


Don't forget to add your gear badge to your gear train!



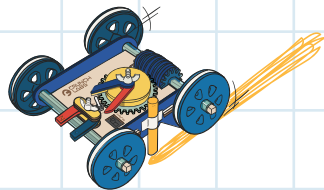
# CRUNCH

It's crunch time! Use your engineering superpowers to keep building.



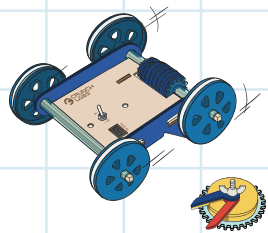
## MOVING THE GOALPOST

Attach a target or basket to your Boomerang Car to create an extra challenging goal!



## SCRIBBLE BOT

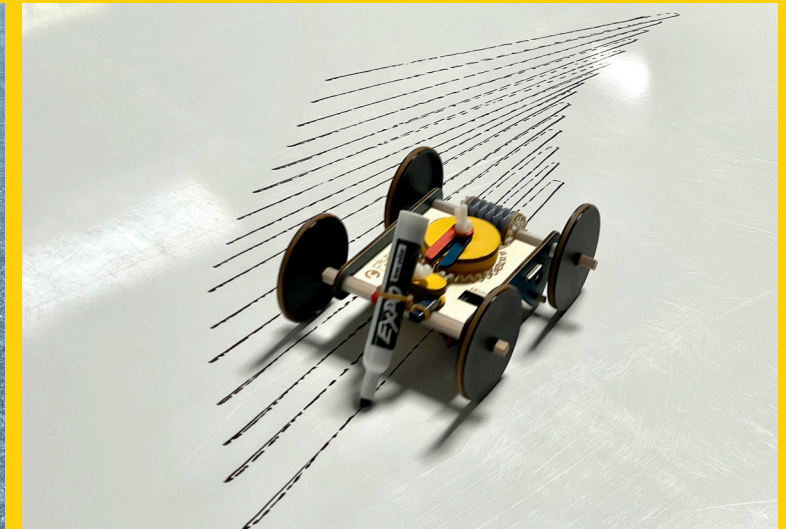
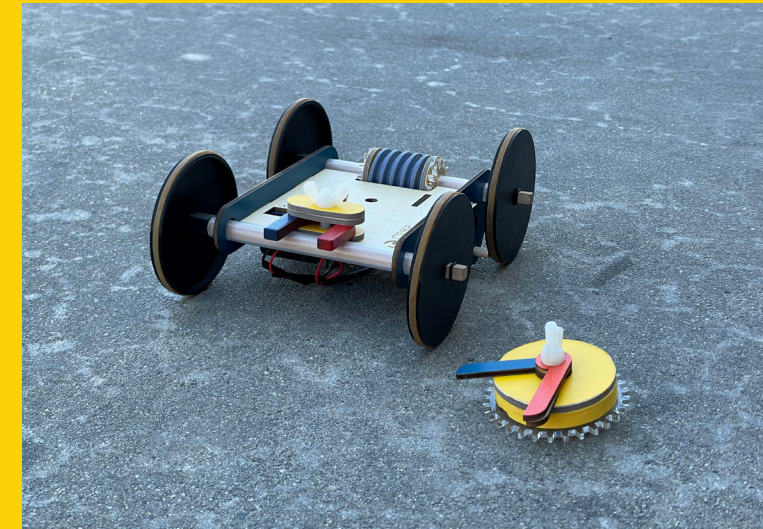
Find a way to install chalk to the car so it draws as it drives. How consistent is the path of the car?



## DRIVE OFF INTO THE SUNSET

If you remove the limit switch, your car won't reverse. It'll just keep driving in one direction until it runs out of batteries. Goodbye car!

# SHOW OFF YOUR BUILD



Share your best boomerangs & coolest mods!

#crunchlabs @crunchlabs    



**WARNING:** Improper assembly can short circuit batteries.

#### **BATTERY SAFETY**

Remove exhausted batteries. Do not mix old & new batteries. Do not mix alkaline, standard (carbon-zinc), or rechargeable batteries. Do not recharge non-rechargeable batteries. If using rechargeable batteries, remove them from the toy before charging. Rechargeable batteries should be charged under adult supervision. Do not short-circuit supply terminals. Do not connect this toy to a power supply greater than two AA batteries. **How to remove batteries:** 1. Remove screw and lid from battery pack. 2. Remove batteries. **How to insert batteries:** 1. Remove screw and lid from battery pack. 2. Insert two new batteries into the battery pack with correct polarity (+ and -). 3. Replace lid and secure the screw on the battery pack.

#### **SWEEPSTAKES**

**Each CrunchLabs build box contains the chance to WIN a trip to visit CrunchLabs with Mark Rober! Sadly, you are not a prize winner this time. Check inside your next build box for another chance to win.**

*Trip includes roundtrip transportation and two (2) night's hotel accommodations for a family of four (4). Approximate value: \$4,500. NO PURCHASE NECESSARY. Open to legal U.S. residents, 18 years of age or older. Void where prohibited. For complete Official Rules, including promotion end date and information on how to obtain a free game ticket, visit [www.crunchlabs.com/win](http://www.crunchlabs.com/win).*

This toy is intended for use by children over the age of eight years. These instructions contain important information, do not throw away.