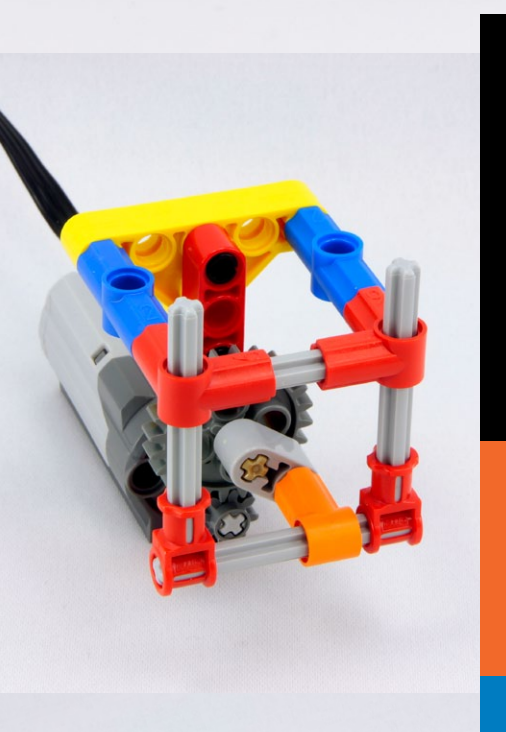
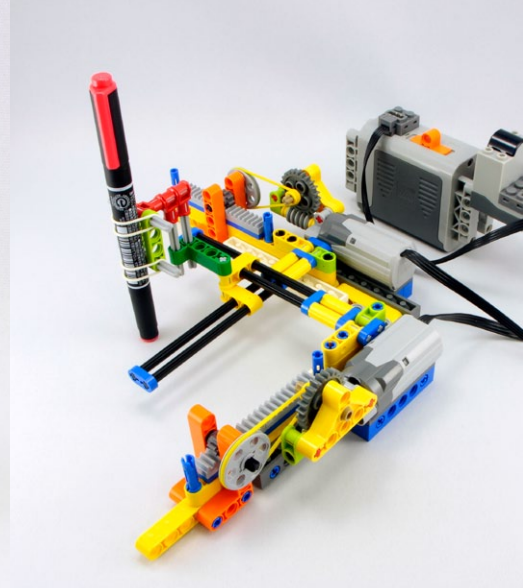
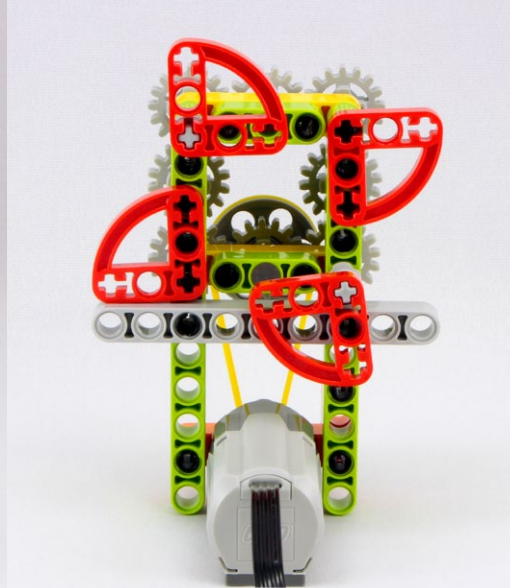
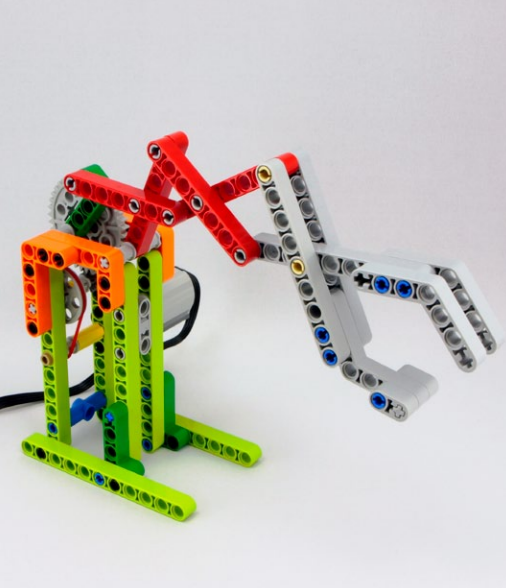
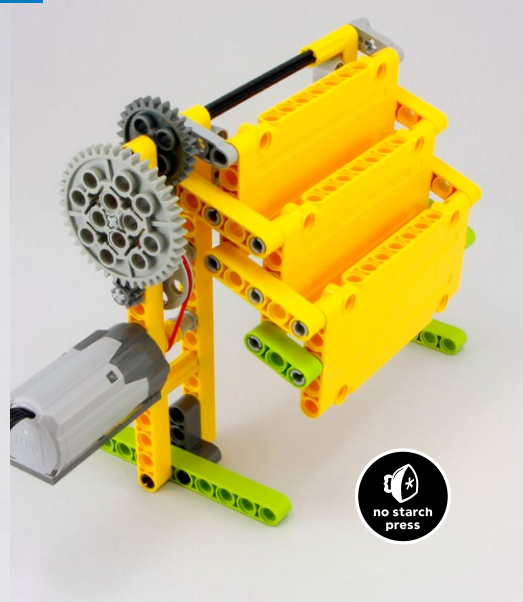
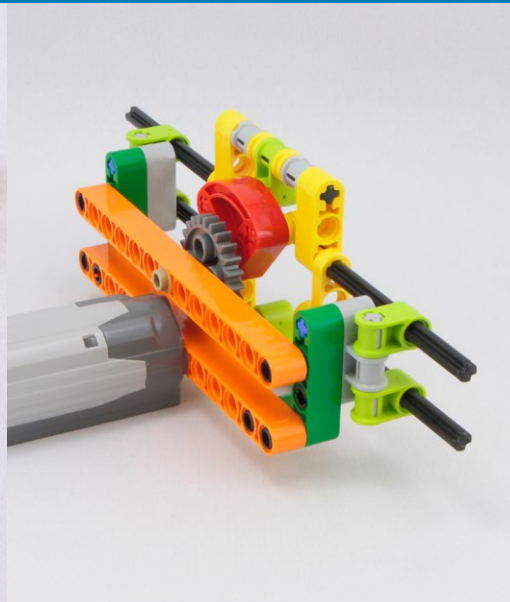
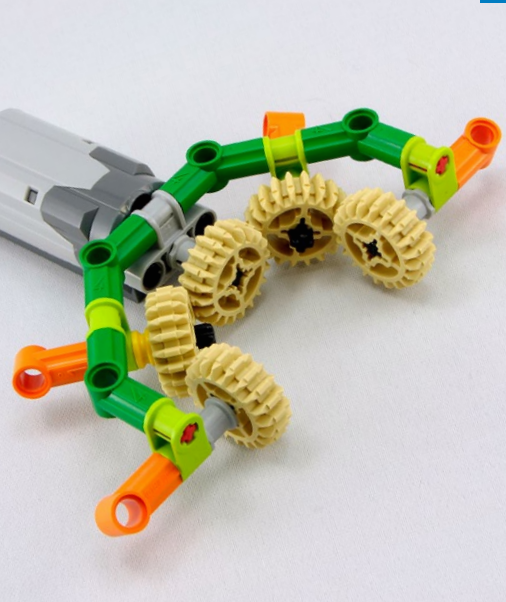




THE LEGO®
POWER
FUNCTIONS
IDEA BOOK
MACHINES AND
MECHANISMS
YOSHIHITO ISOGAWA



THE LEGO® POWER FUNCTIONS IDEA BOOK
MACHINES AND MECHANISMS

VOLUME 1

THE LEGO®
POWER
FUNCTIONS
IDEA BOOK

MACHINES AND
MECHANISMS

Y O S H I H I T O I S O G A W A



The LEGO® Power Functions Idea Book, Volume 1: Machines and Mechanisms.

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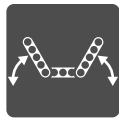
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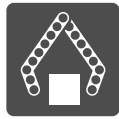
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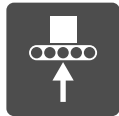
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Introduction

This is an idea book, offering hundreds of projects and mechanisms you can build with LEGO Technic parts. The book especially focuses on LEGO Power Functions, which is the latest version of the Technic system of motors, lights, and other electric building elements.

Where Are the Words?

Other than this brief introduction and the table of contents, this book has almost no words. Instead, you'll find a series of photographs of increasingly complex models, each designed to demonstrate a mechanical principle or building technique.

While the book lists the pieces needed to build each model, it does not include step-by-step building instructions. Look at the photographs taken from various angles and try to reproduce the model. Building in this way is something like putting together a puzzle. You'll get the hang of it after a little practice.

The Use of Color

The examples in this book are made with parts of various colors to make it easier for you to see the individual bricks' shapes. But you don't need to use the colors I've chosen in your models; use whichever colors you want to make the projects your own.

Substituting Parts

The parts used in this book were selected from among the easily obtainable ones as much as possible, but you'll probably still be missing a few.

Try to build as many models as possible using the parts that you already own. If you find that you're missing parts, try to think of ways to substitute other parts for the ones that you're missing.

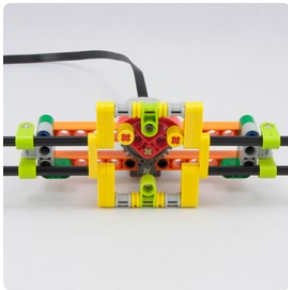
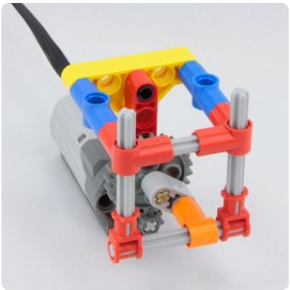
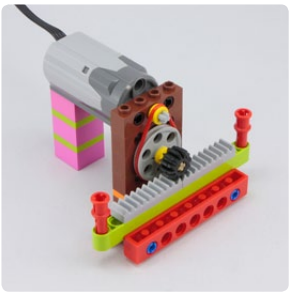
For example, there are many types of LEGO tires. If you don't have the tires shown in a particular project, try using any tires you have that are a similar size. Also, there are several types of Power Functions motors. In this book, the commonly available Medium (M) motors are used most frequently. It's relatively easy to replace the M motor with the Large (L) motor or older motors from earlier systems, so use whatever you have available.

The Parts List in the back of the book will help you find the pieces you need.

You Are the Creator

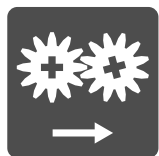
Look at the models you build closely. By thinking about how they move and why they are designed that way, you will greatly improve your building skills.

This is an idea book; it's about imagination. It is my sincere hope that you make these projects your own, combine them, and evolve them into something even better—your own original models.

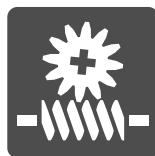


PART 1

Basic Mechanisms



4



52



90



114



154



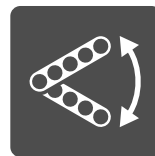
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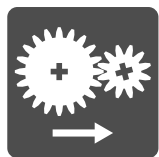
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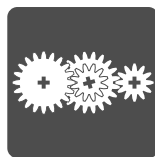
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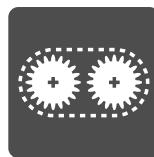
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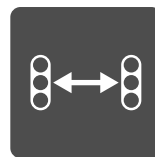
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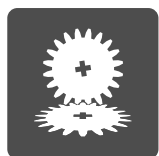
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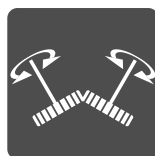
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178



42



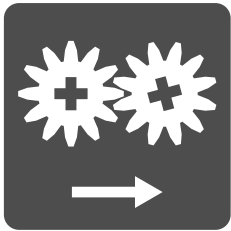
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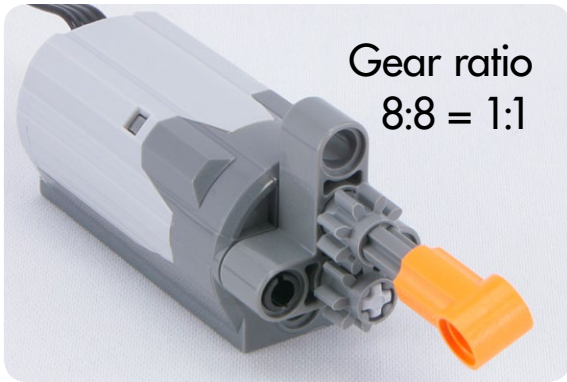
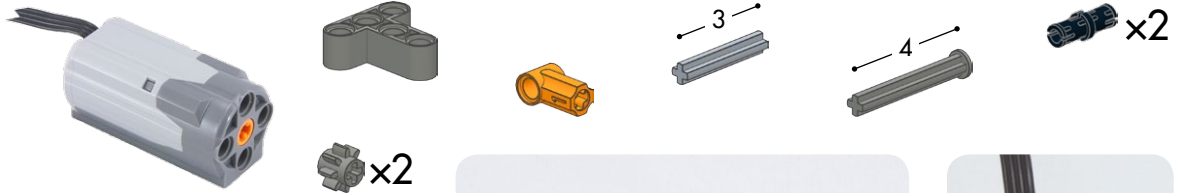


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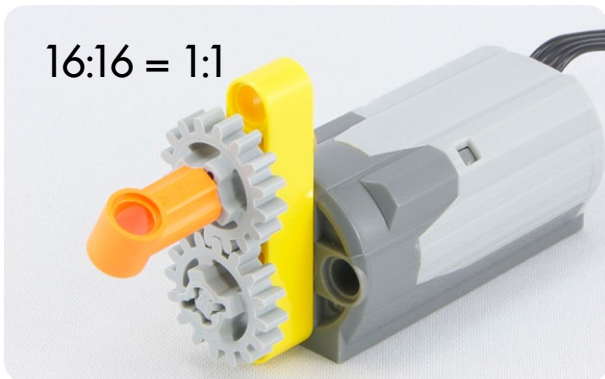
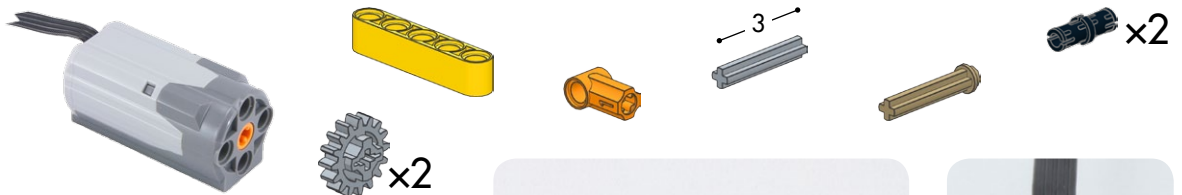


Transmitting rotation

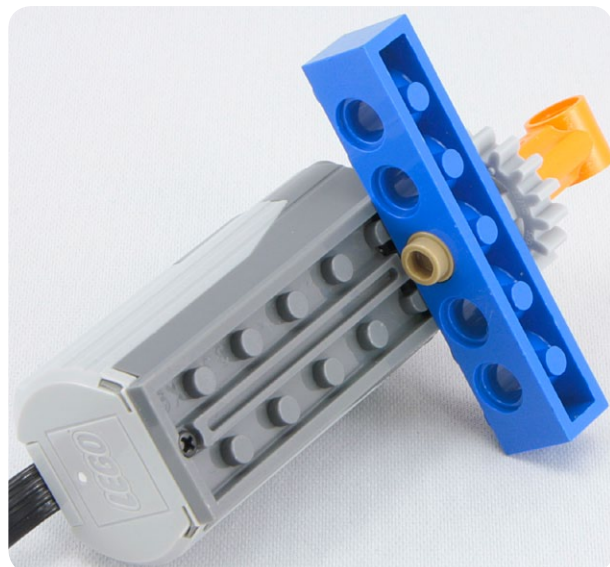
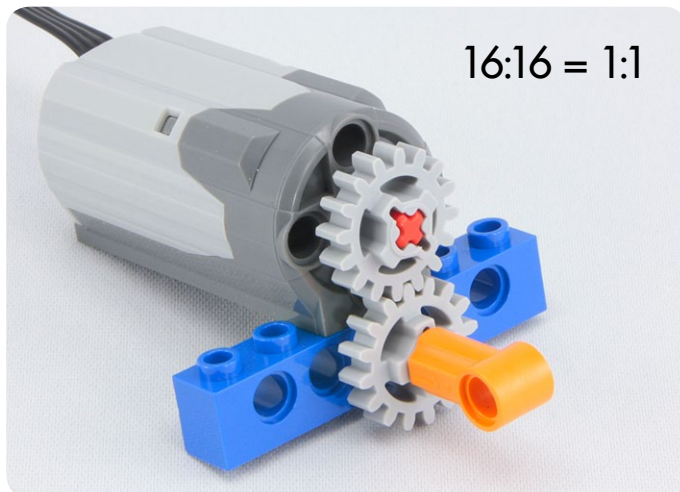
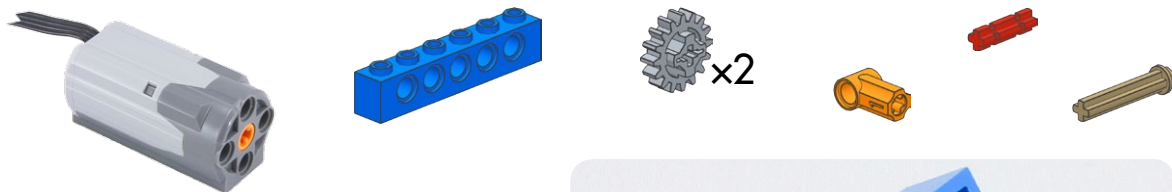
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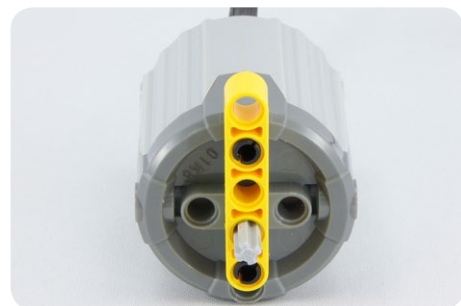
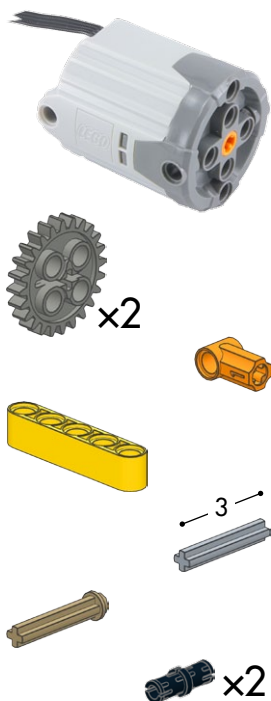
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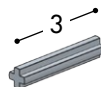
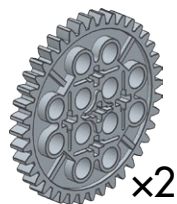
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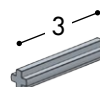
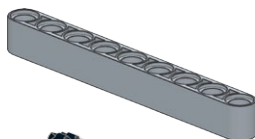
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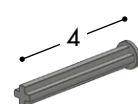
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x2



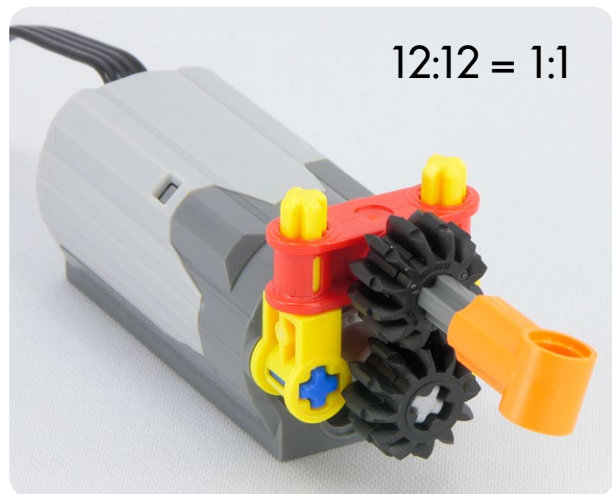
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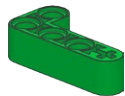
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#8



x2



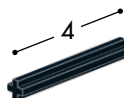
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x2



x2



4



x2



x2



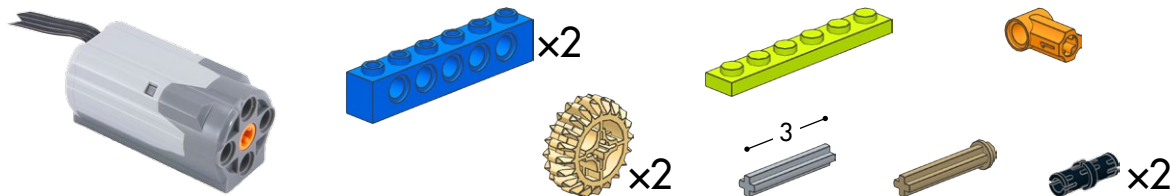
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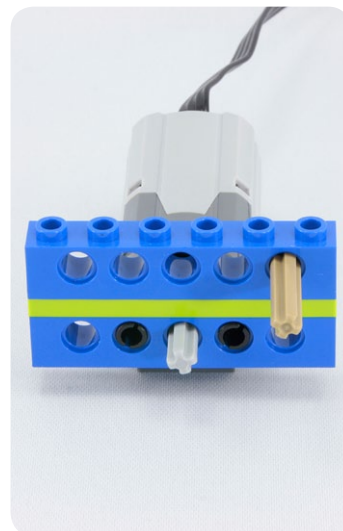
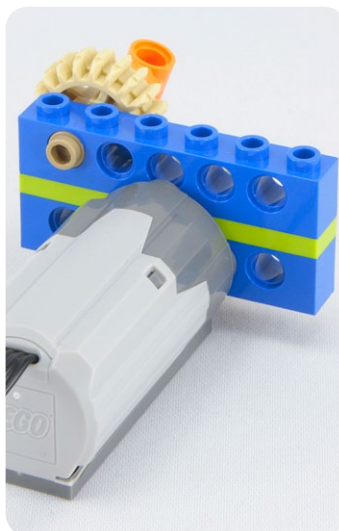
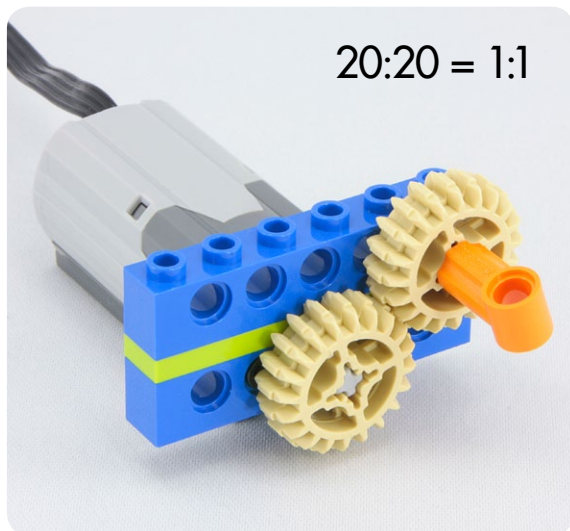
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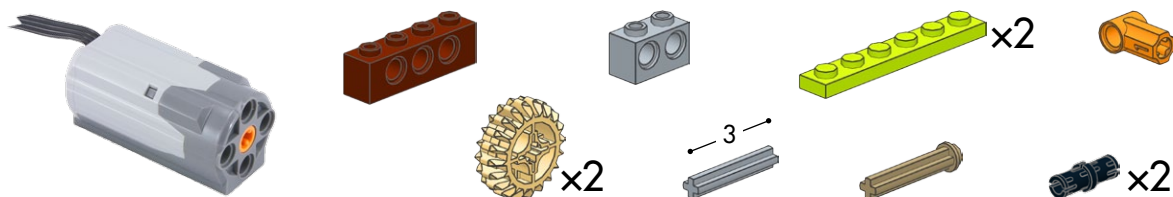
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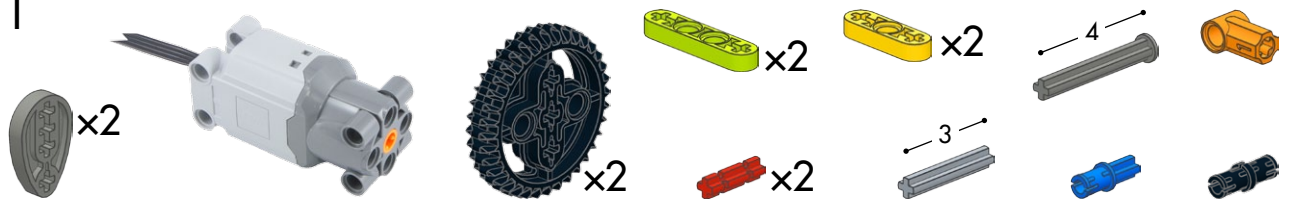
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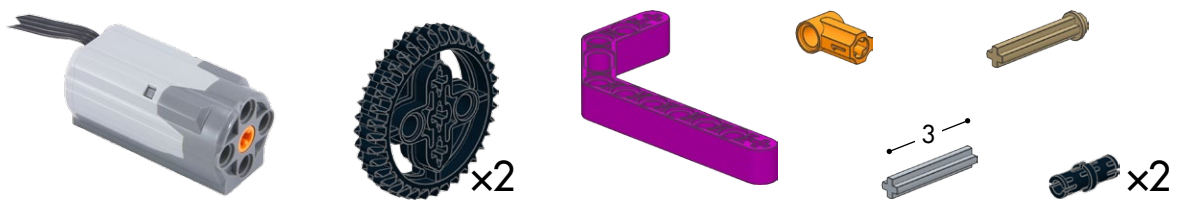
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#12



36:36 = 1:1



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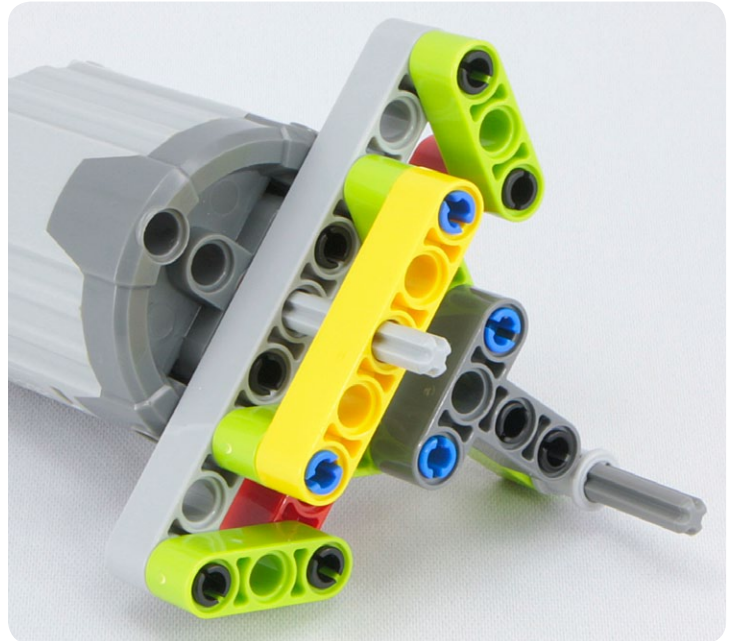
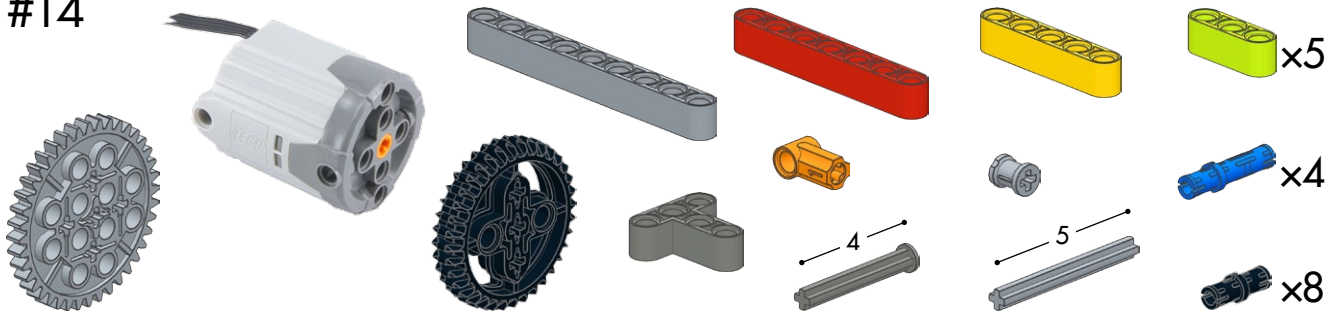
36:40 = 9:10 ► 0.90



A photograph of a LEGO Technic assembly. It features a grey motor with a black cable, connected to a grey 40-tooth gear. This gear is meshed with a smaller grey 36-tooth gear. An orange connector is attached to the 36-tooth gear. A yellow Technic piece is also visible, connected to the 40-tooth gear. The assembly is shown from a side-on perspective, highlighting the gear ratio.

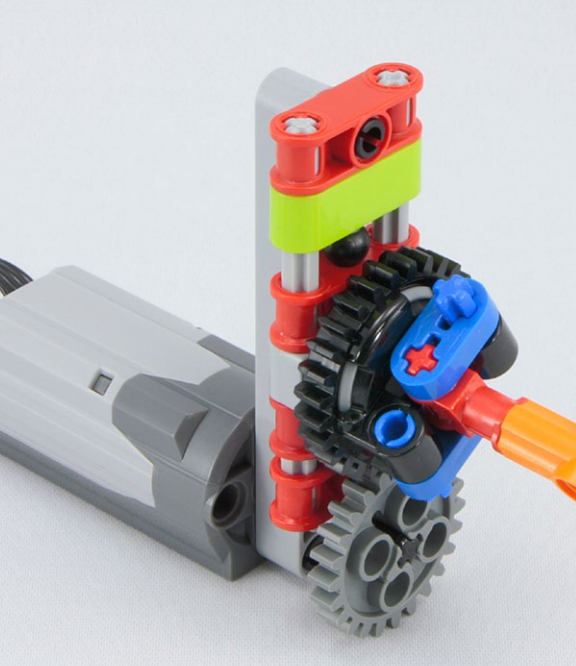


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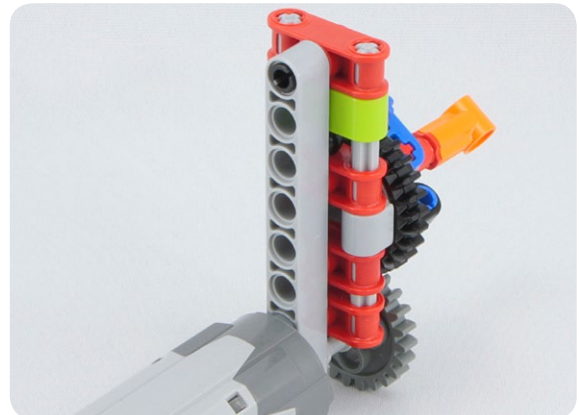


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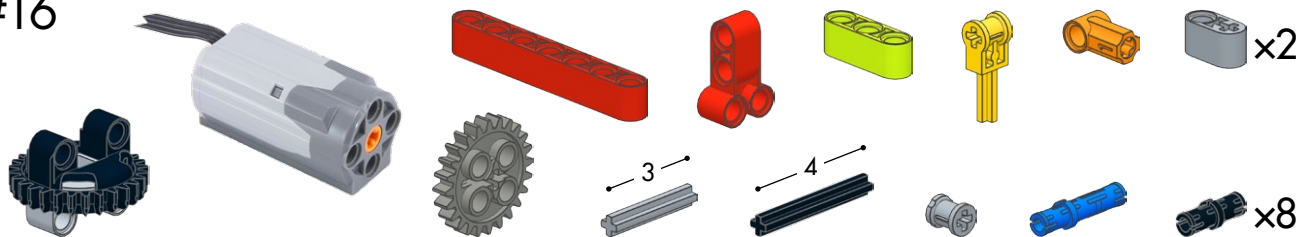
24:28 = 6:7 ▶ 0.86



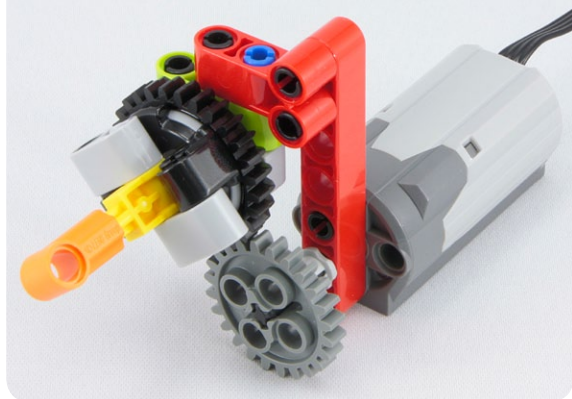
A photograph of a LEGO Technic assembly. On the left is a grey motor with a black cable. A grey axle extends from the motor, passing through a series of gears. The gears include a large grey 24-tooth gear at the bottom, a smaller grey gear, and a black gear. A blue Technic connector is attached to the black gear. A red Technic beam is connected to the top of the gear train. The entire assembly is built on a white background.



#16



$24:28 = 6:7 \triangleright 0.86$



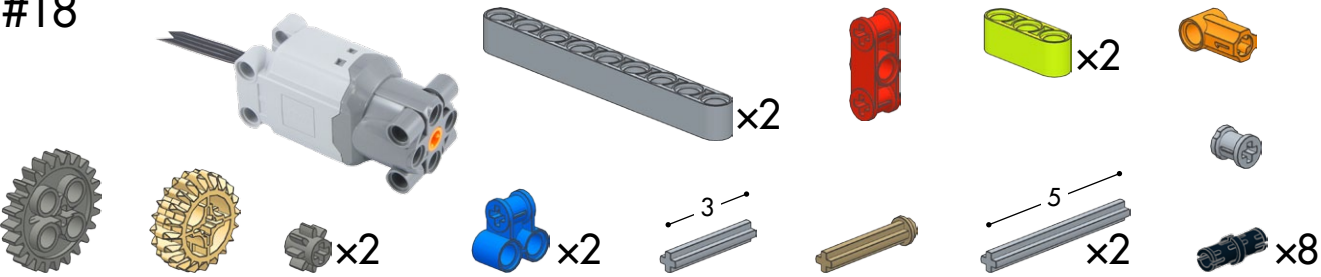
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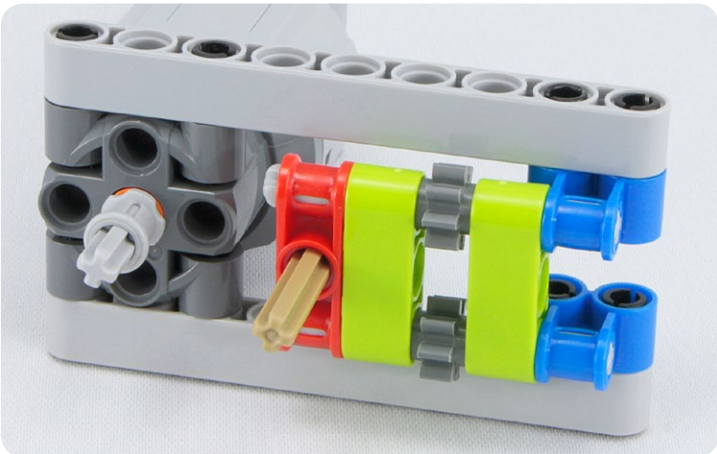
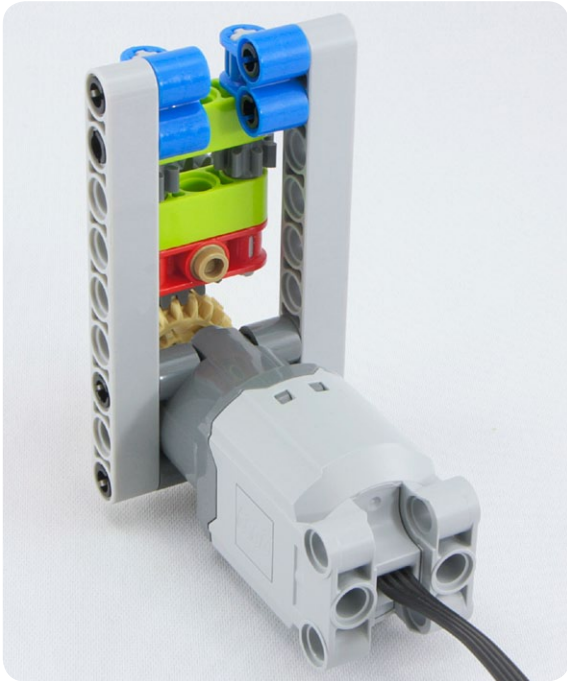
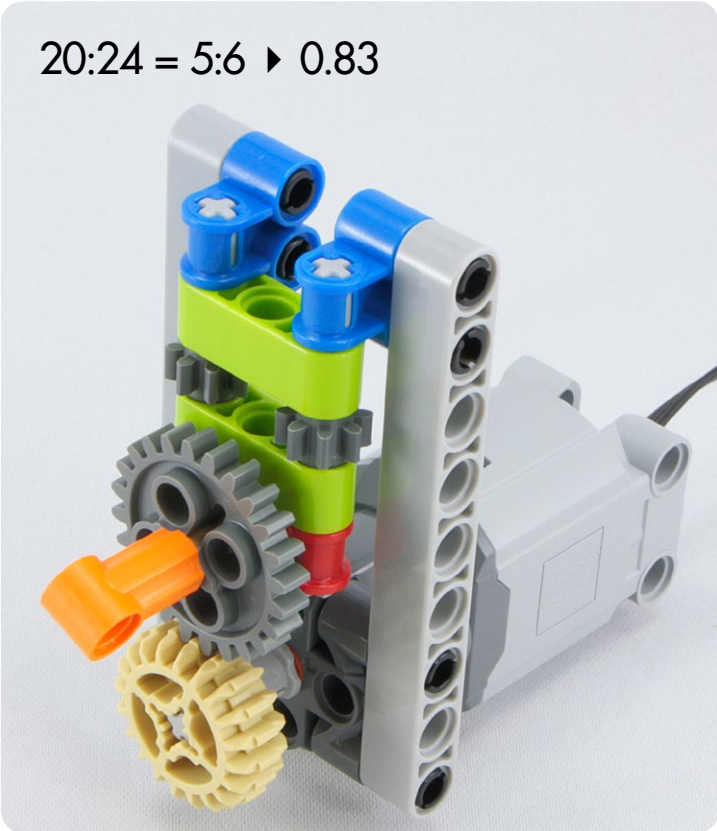
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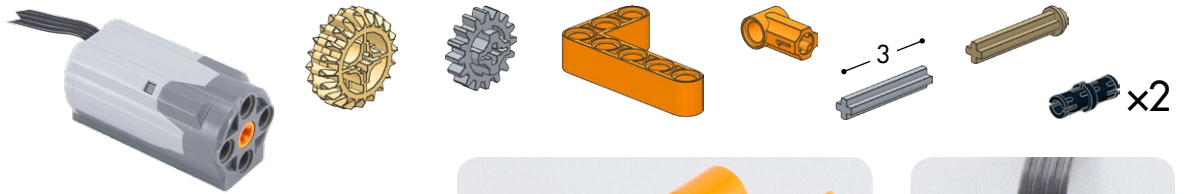
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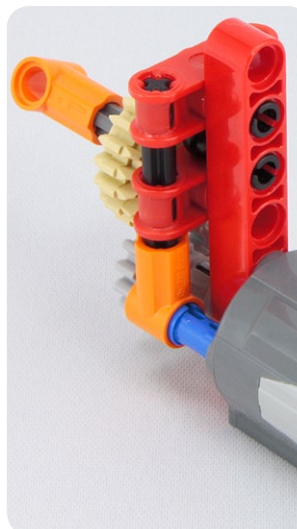
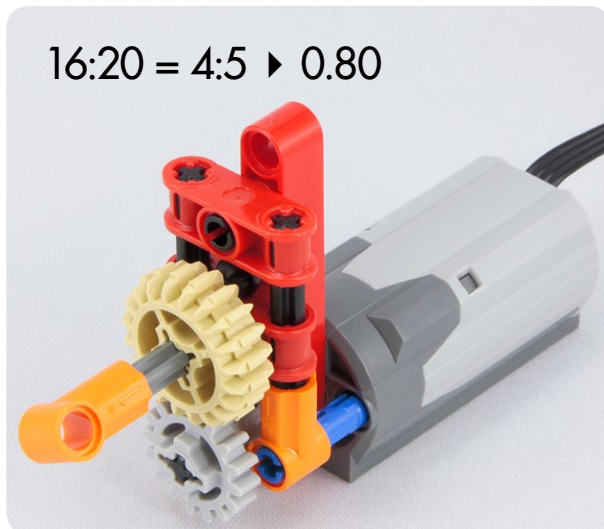
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#19



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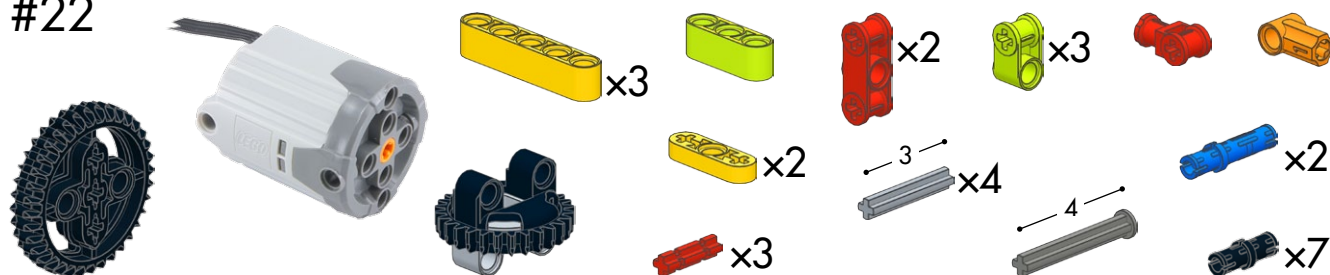
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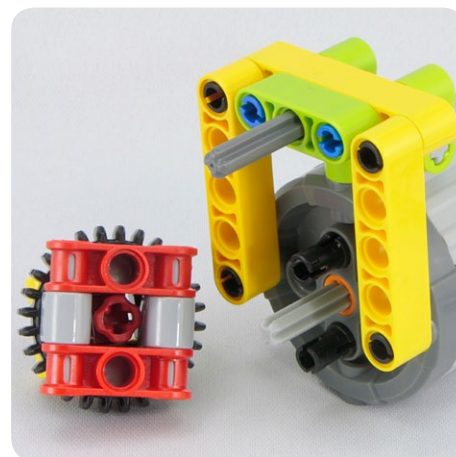
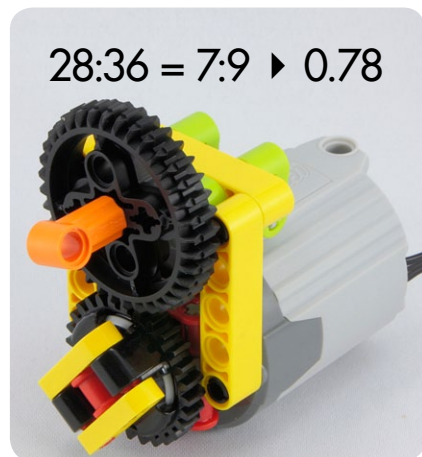
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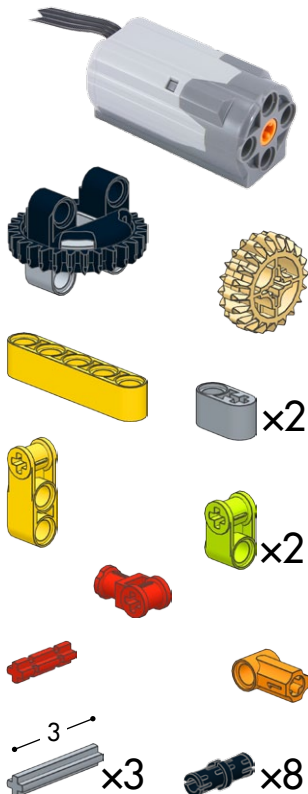
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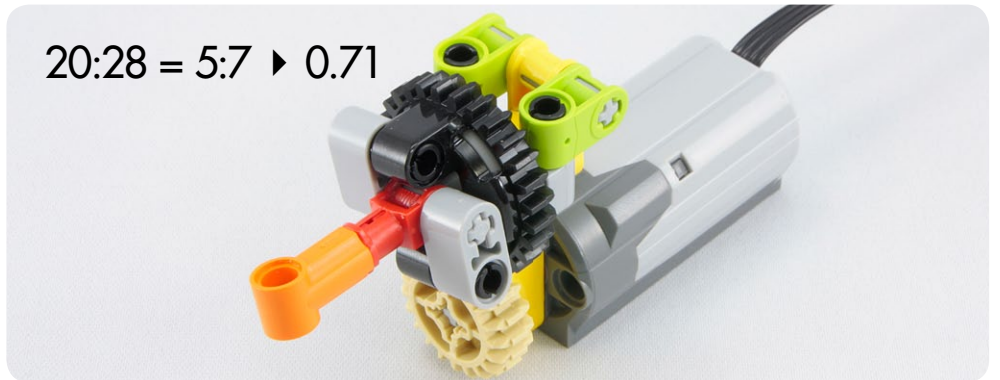
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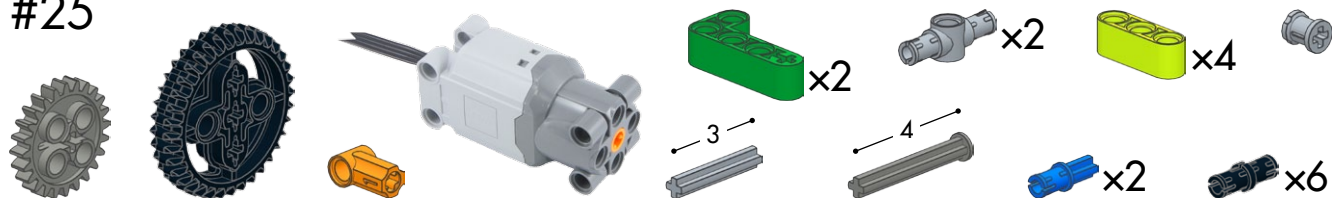
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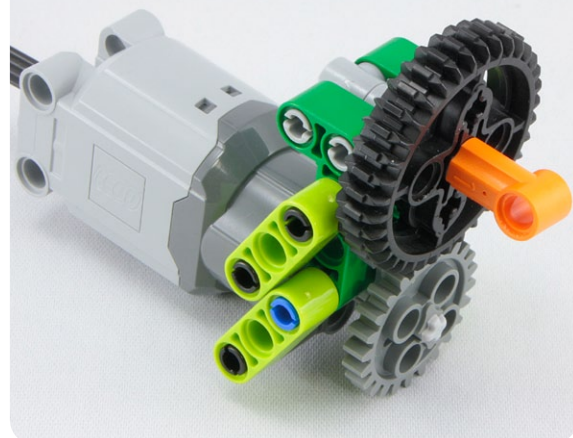
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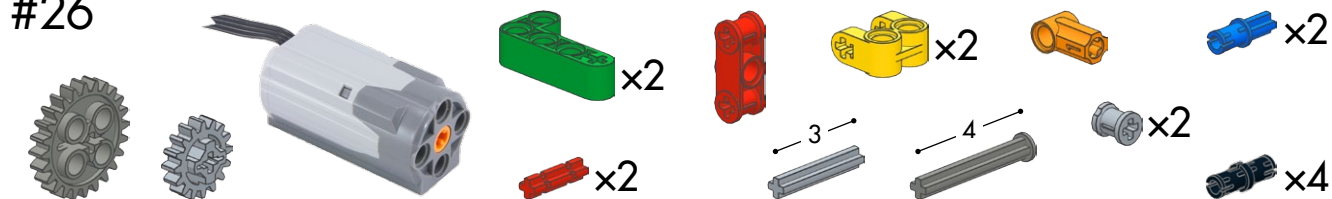
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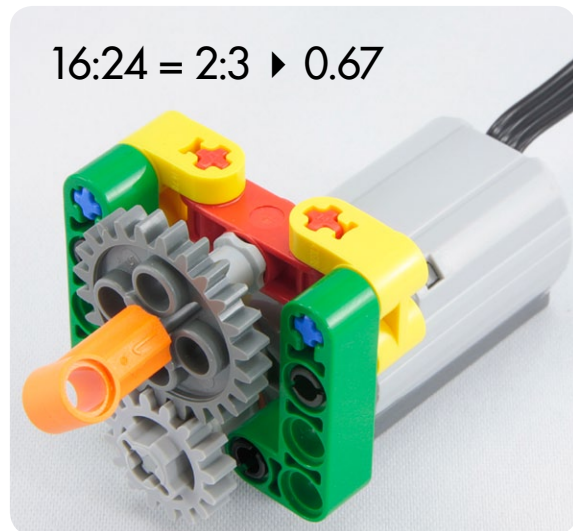
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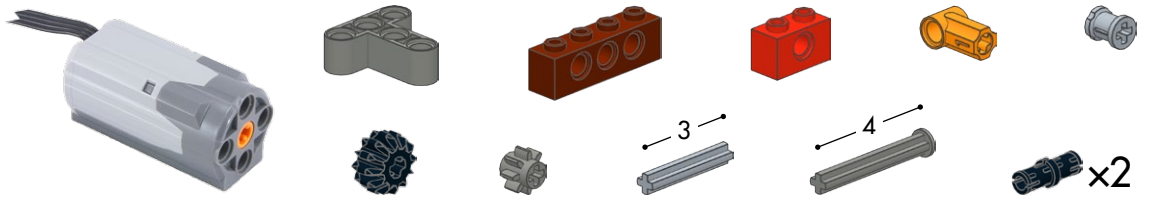
#26



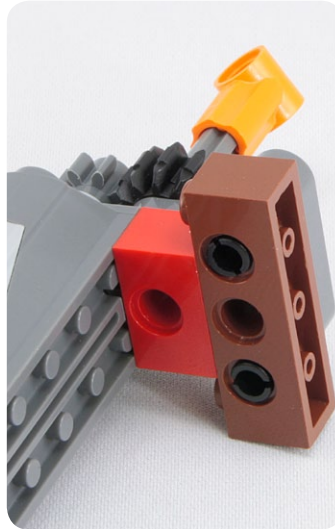
$$16:24 = 2:3 \rightarrow 0.67$$



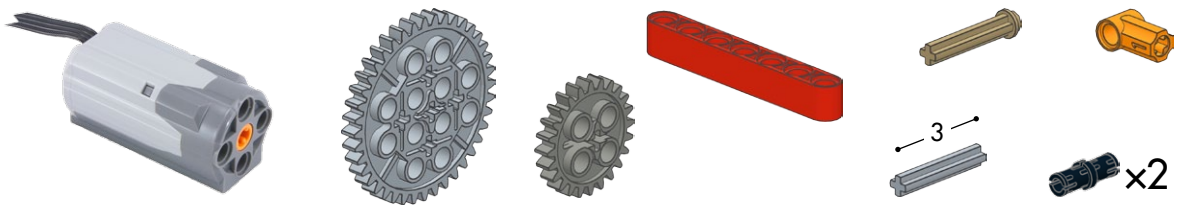
#27



$8:12 = 2:3 \triangleright 0.67$



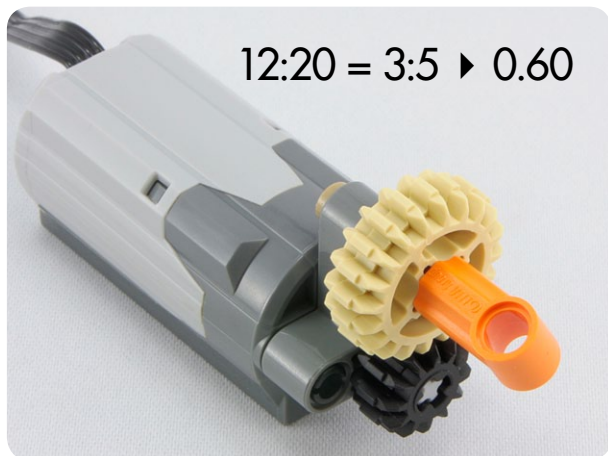
#28



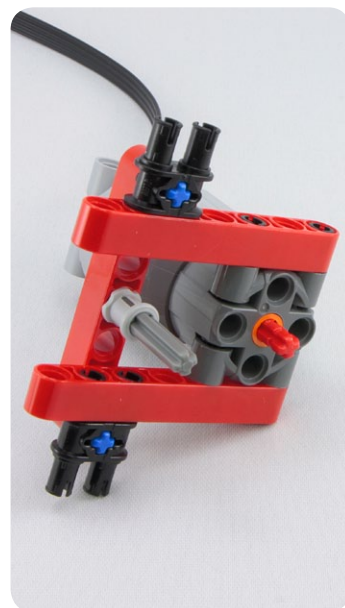
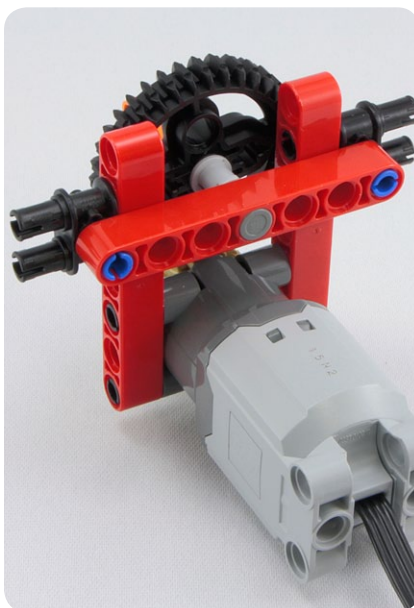
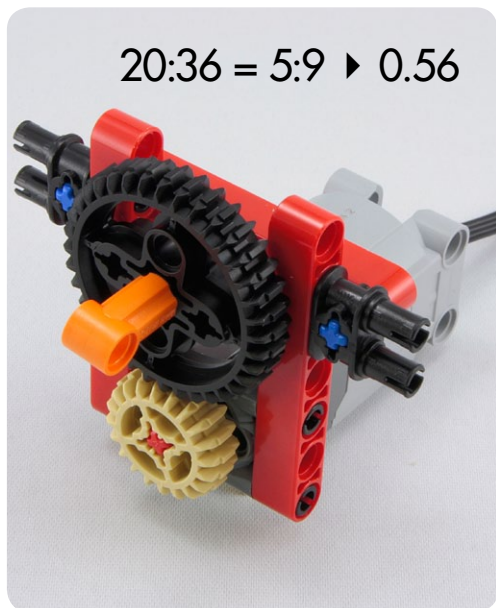
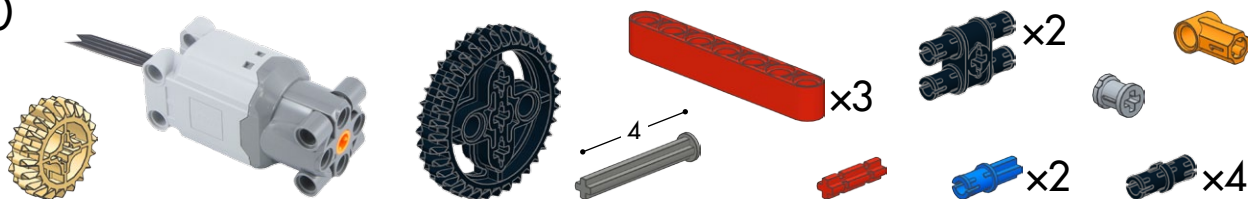
$24:40 = 3:5 \triangleright 0.60$



#29



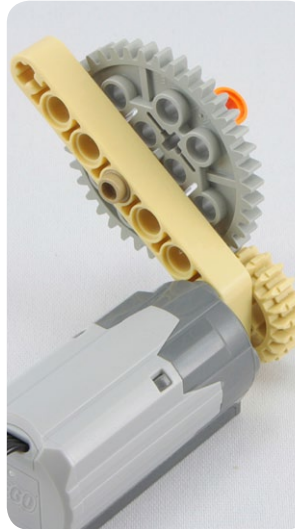
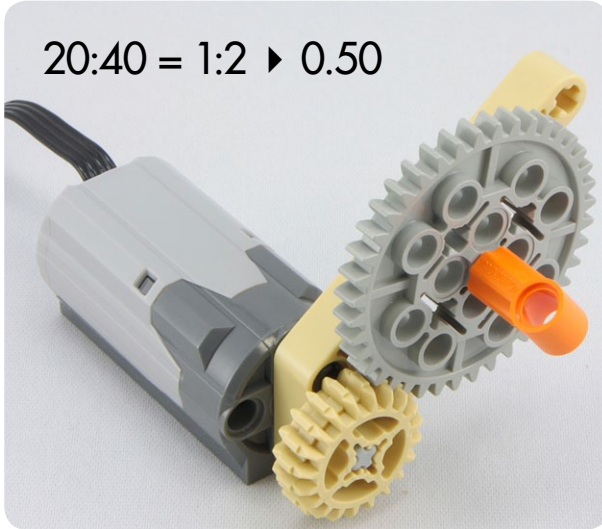
#30



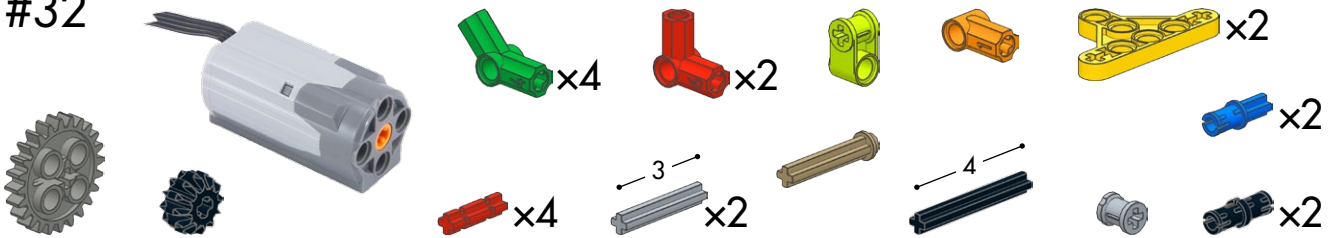
#31



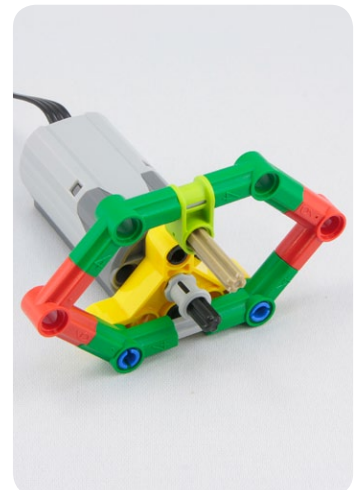
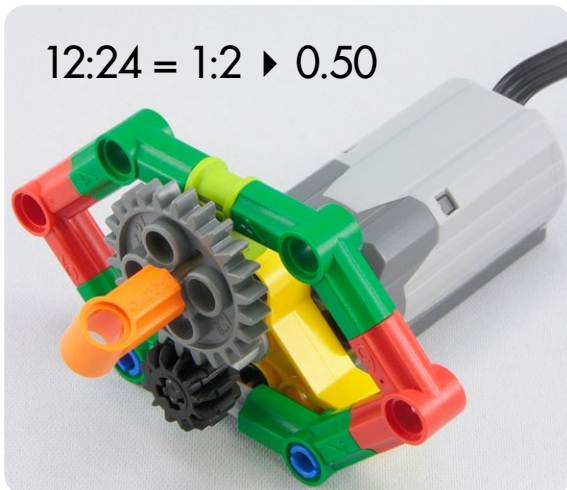
$20:40 = 1:2 \rightarrow 0.50$



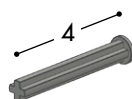
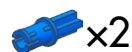
#32



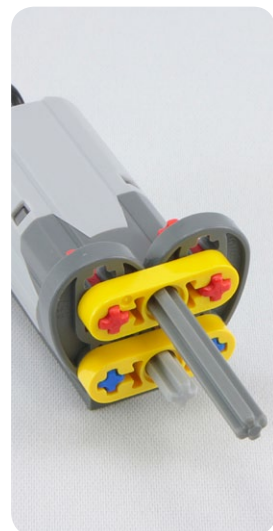
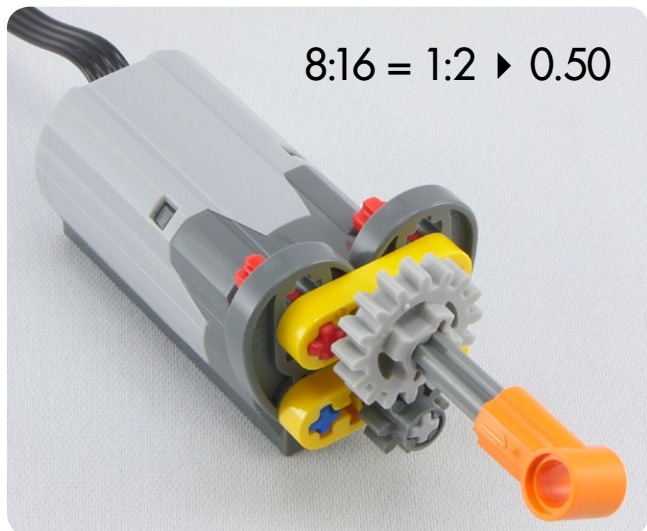
$12:24 = 1:2 \rightarrow 0.50$



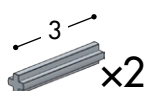
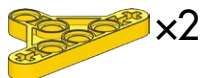
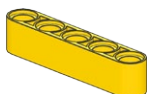
#33



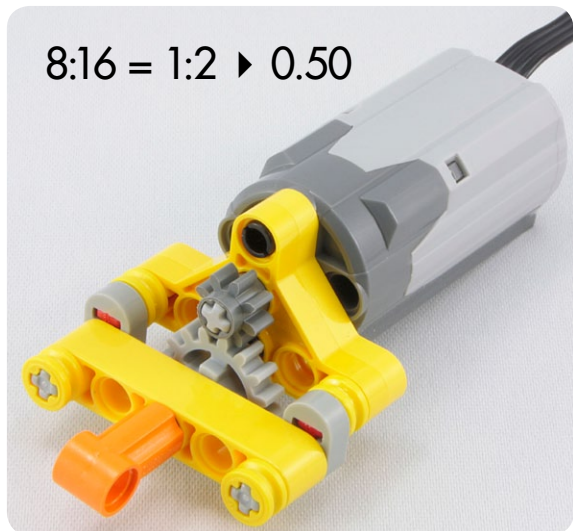
8:16 = 1:2 ▶ 0.50



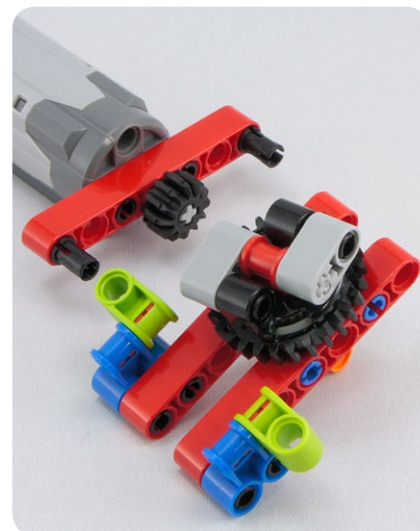
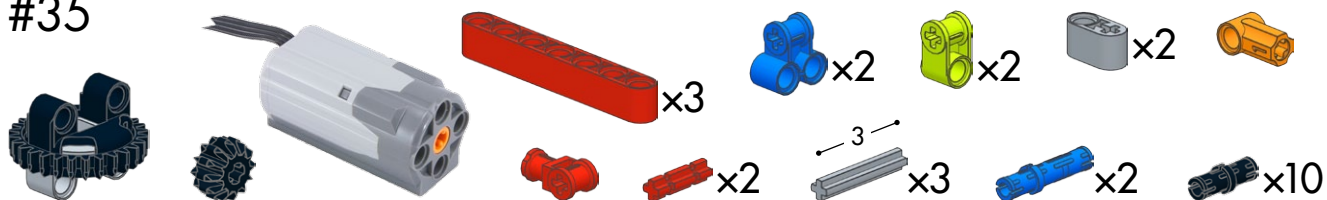
#34



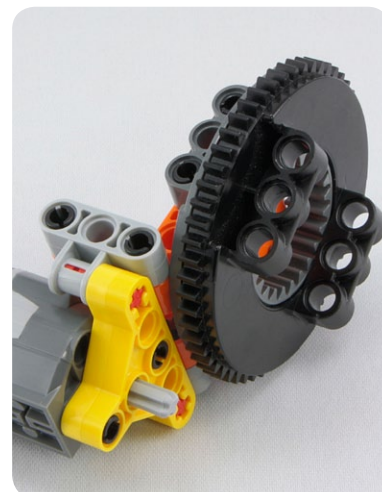
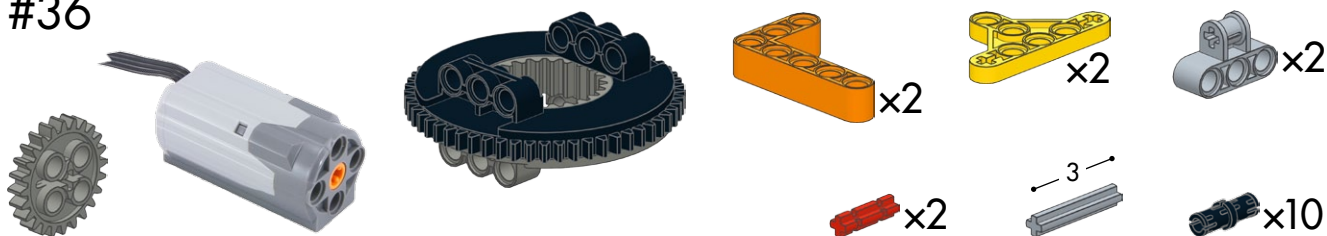
8:16 = 1:2 ▶ 0.50



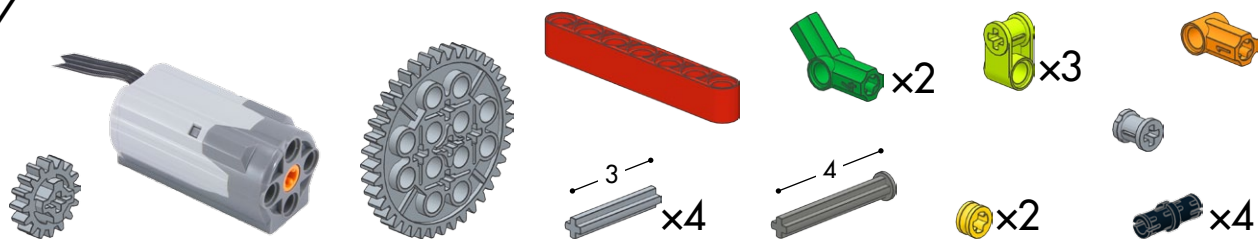
#35



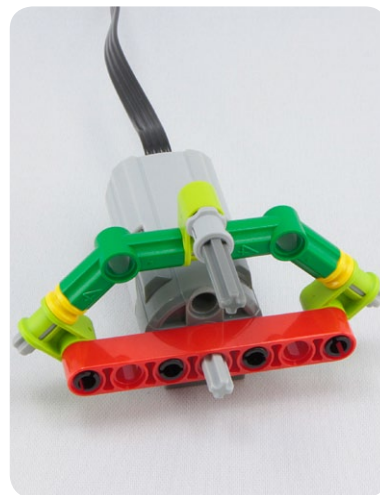
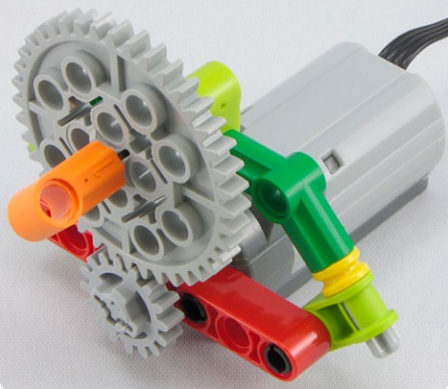
#36



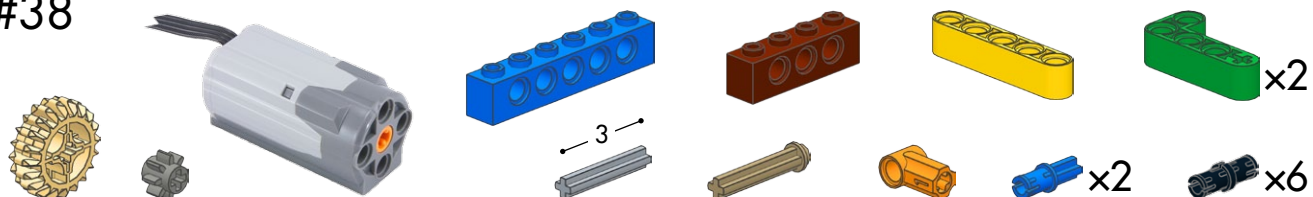
#37



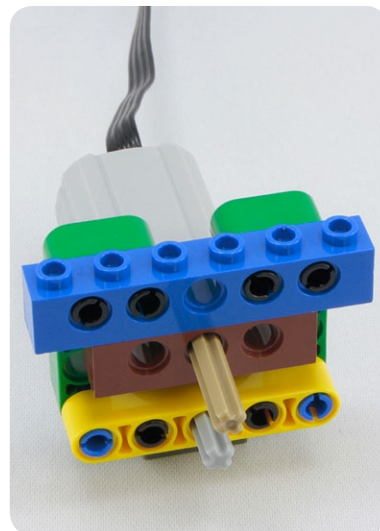
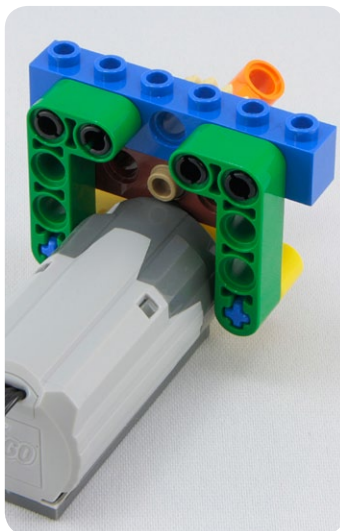
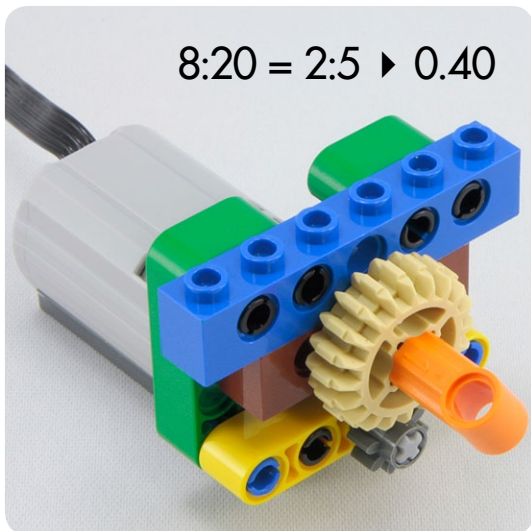
16:40 = 2:5 ▶ 0.40



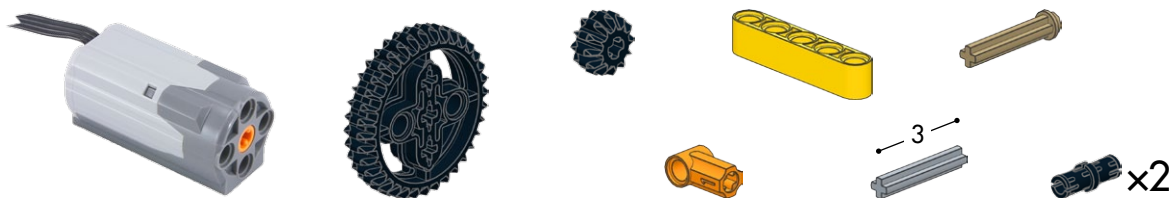
#38



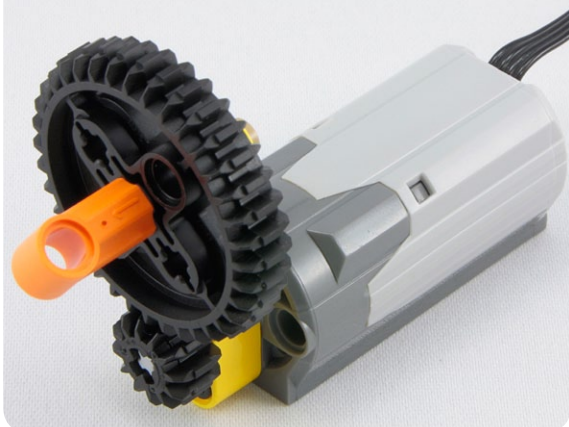
8:20 = 2:5 ▶ 0.40



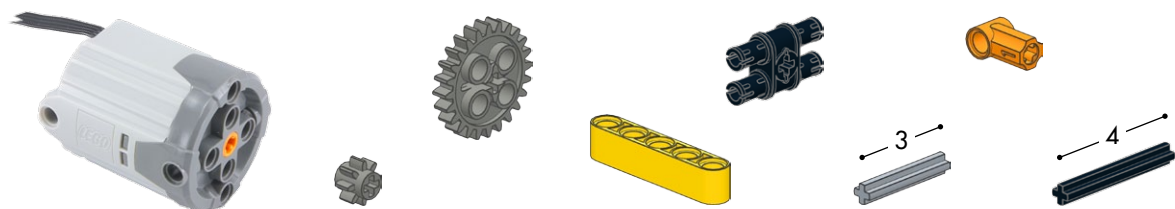
#39



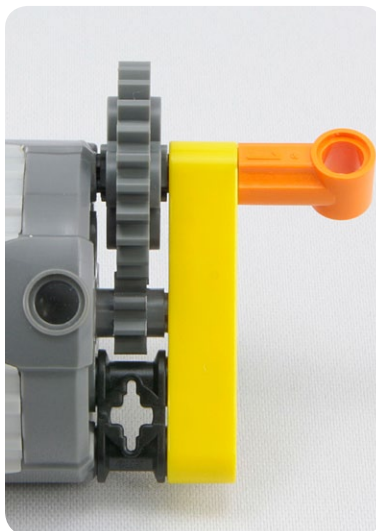
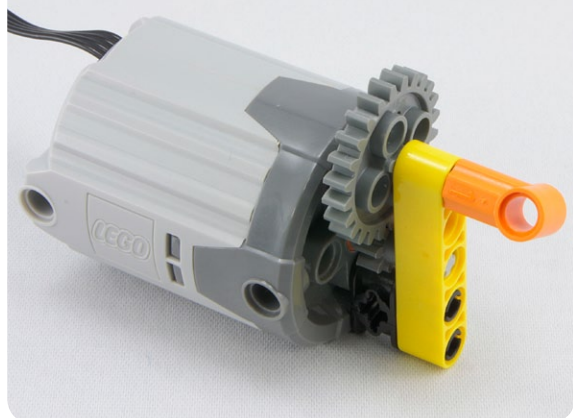
$12:36 = 1:3 \triangleright 0.33$



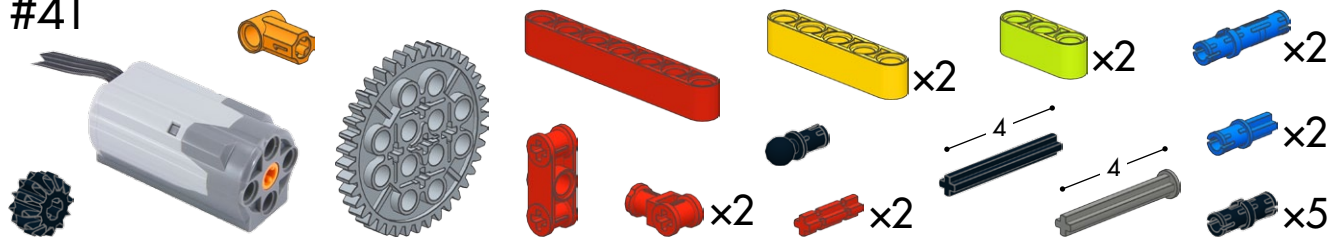
#40



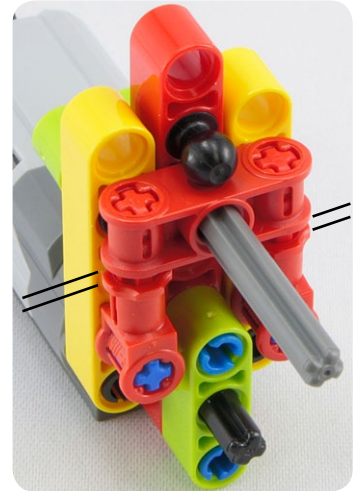
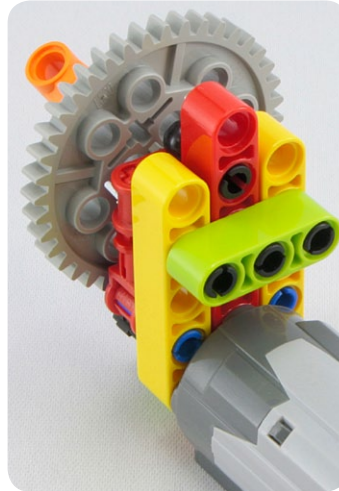
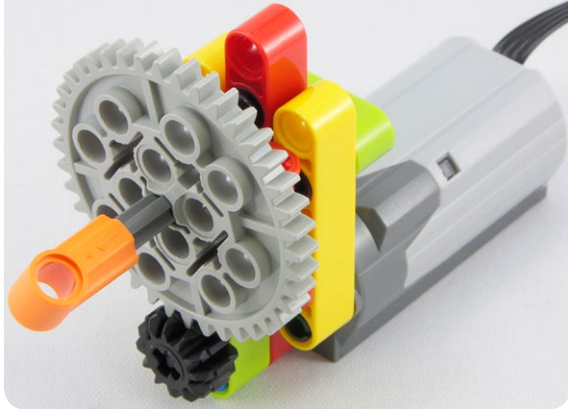
$8:24 = 1:3 \triangleright 0.33$



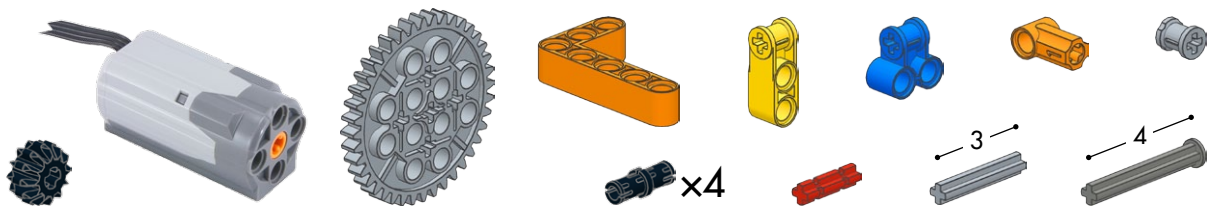
#41



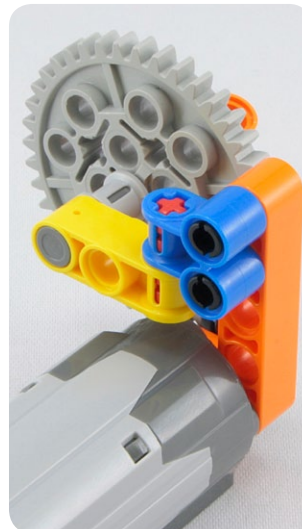
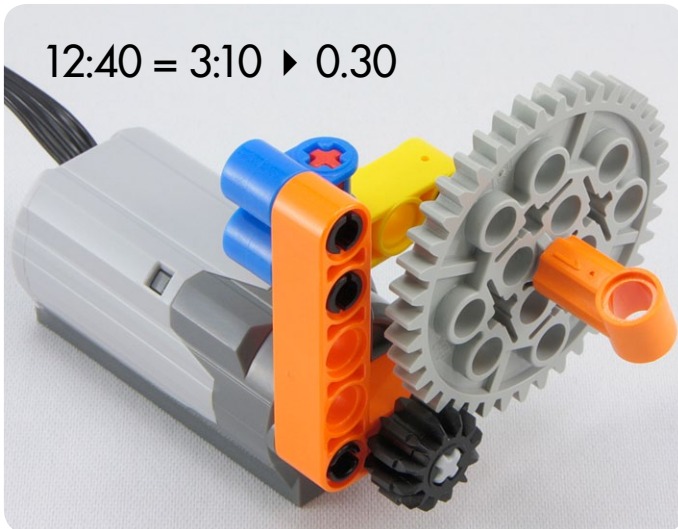
12:40 = 3:10 ▶ 0.30



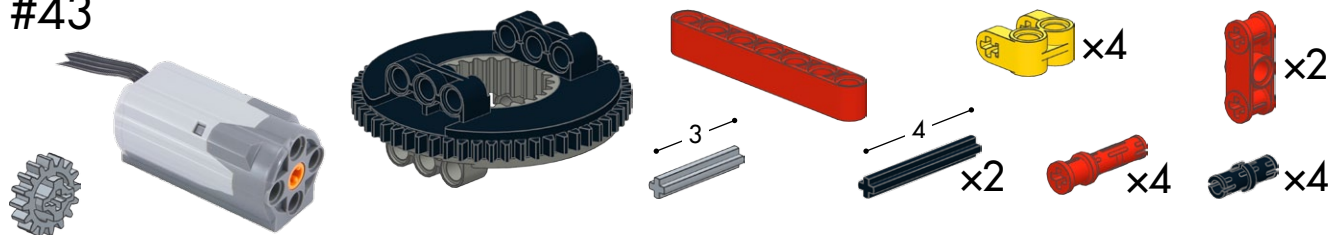
#42



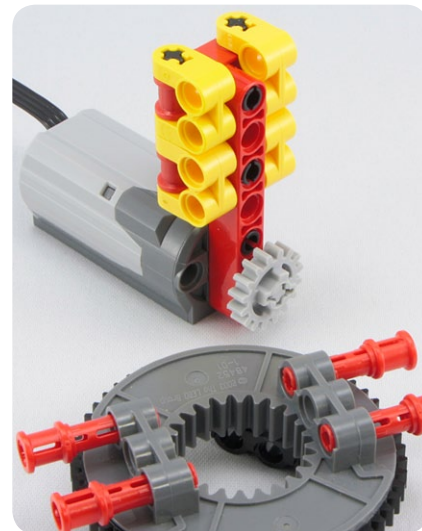
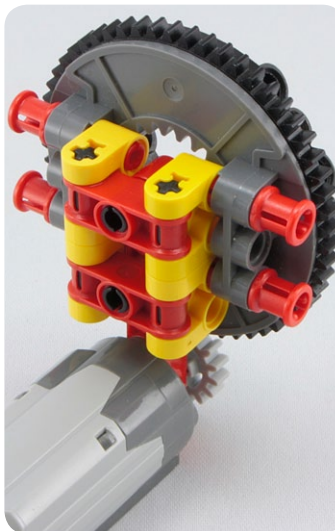
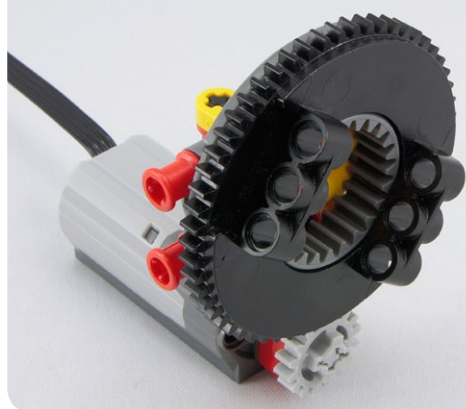
12:40 = 3:10 ▶ 0.30



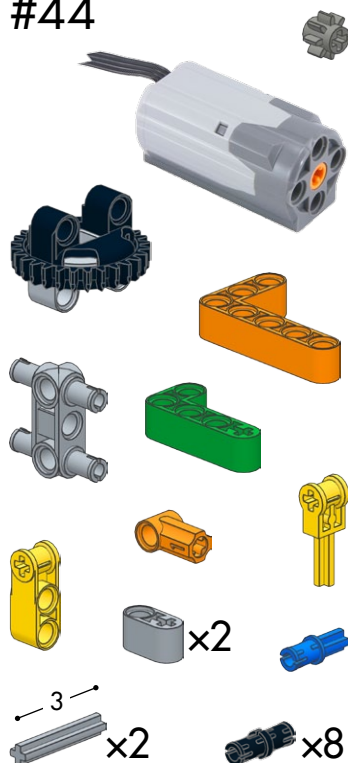
#43



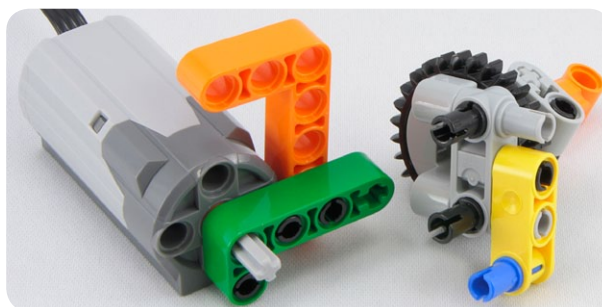
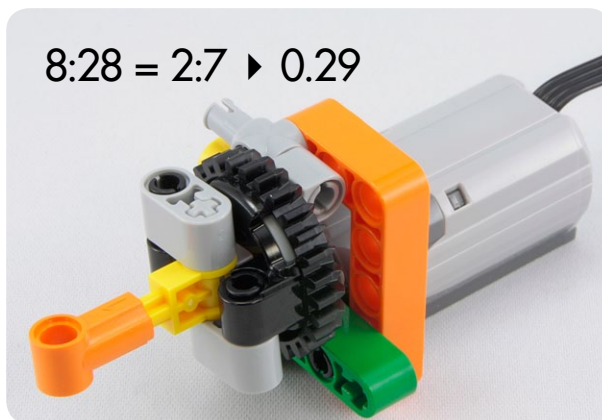
16:56 = 4:14 ▶ 0.29



#44



8:28 = 2:7 ▶ 0.29

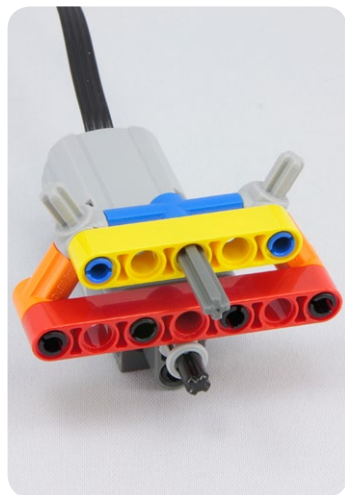


#45



LEGO parts list for step 45:

- 1x Large black gear
- 1x Grey motor
- 1x Red 1x6 Technic beam
- 1x Yellow 1x6 Technic beam
- 1x Grey 3-way connector
- 1x Blue 1x3 Technic connector
- 3x Orange 1x3 Technic connector
- 1x Small grey connector
- 2x Grey 1x3 Technic connector
- 4x Black 1x2 Technic axle
- 4x Grey 1x2 Technic axle
- 2x Blue 1x2 Technic connector
- 6x Black 1x2 Technic connector



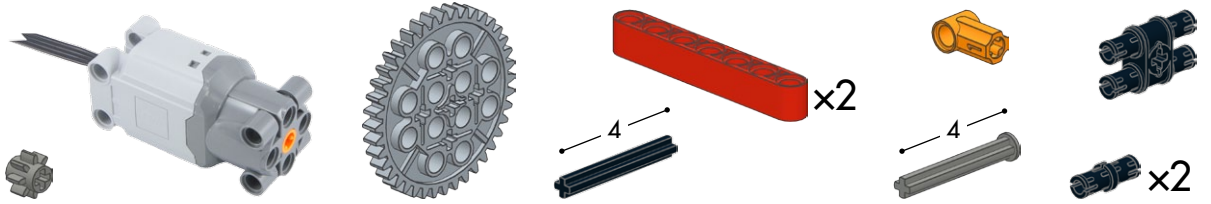
#46

This diagram shows the parts required for step 46:

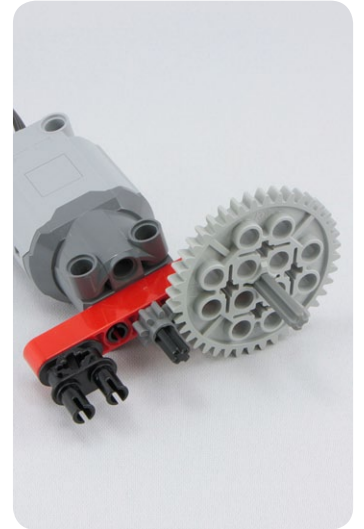
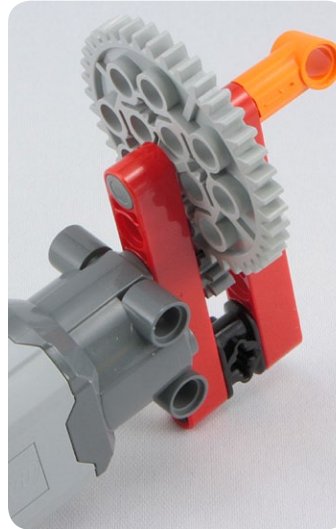
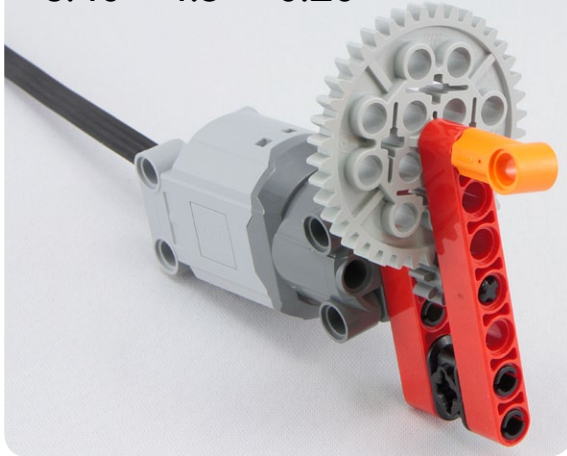
- A large dark blue gear assembly.
- A small black gear.
- A grey motor unit.
- A grey connector piece.
- A yellow 1x7 Technic beam.
- An orange 1x5 Technic beam.
- A grey axle with a pin inserted, labeled with the number 3.
- Six black pins, indicated by "x6".



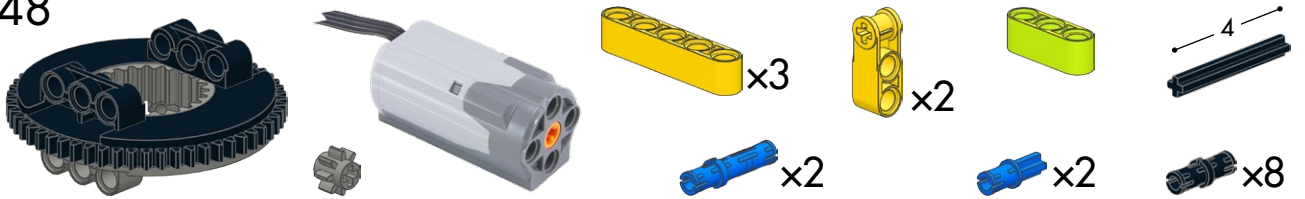
#47



8:40 = 1:5 ▶ 0.20

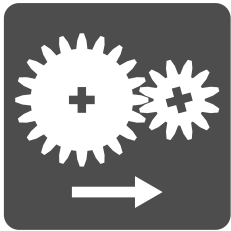


#48



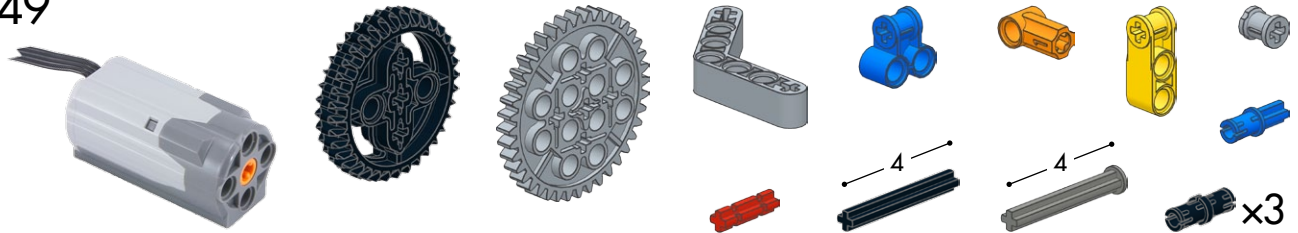
8:56 = 1:7 ▶ 0.14



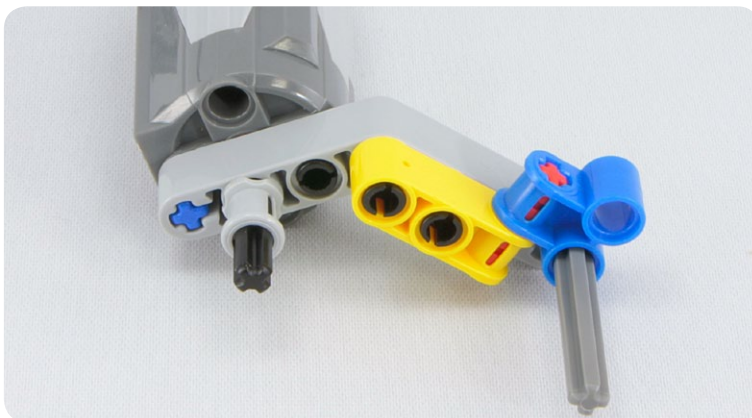


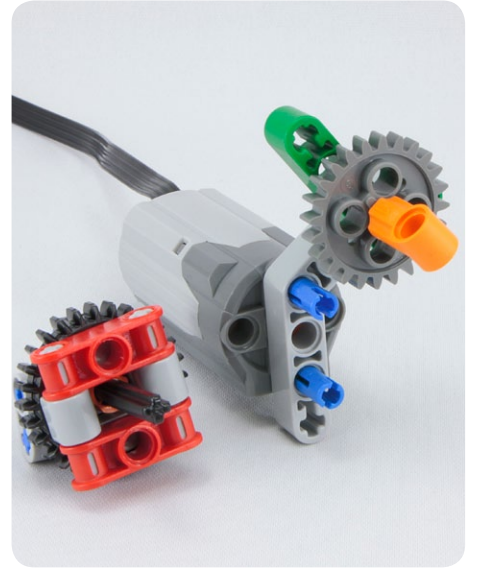
Gearing up (speeding up)

#49



$40:36 = 10:9 \triangleright 1.11$

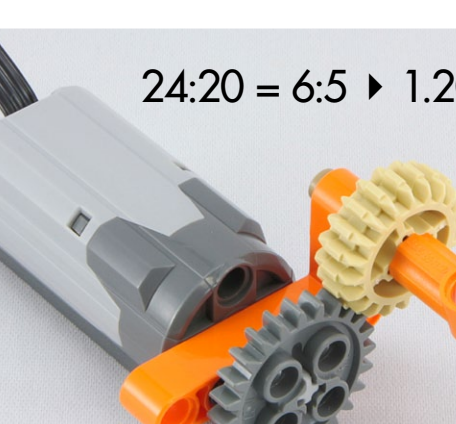


[illegible][illegible]

#51



1 small orange connector, 1 grey motor, 1 grey gear, 1 yellow gear, 1 orange 1x3 Technic beam, 1 grey axle with 3 pins, 1 tan axle, and 2 black connectors.

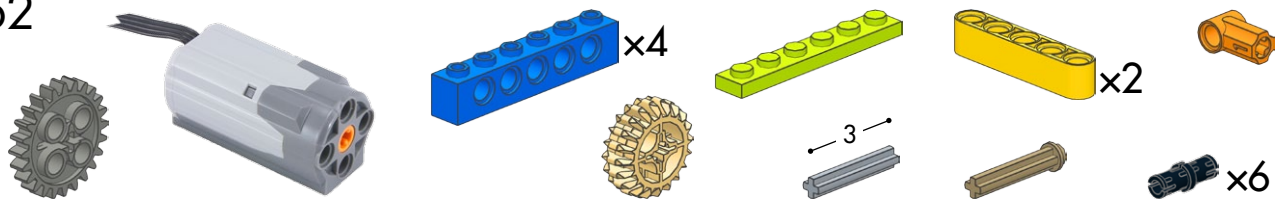


A photograph of a LEGO Technic assembly. It features a grey motor with a black cable, connected to an orange axle. A large grey gear is mounted on the axle, which is also connected to a smaller yellow gear. The gears are meshed together. The background is a plain, light-colored surface.

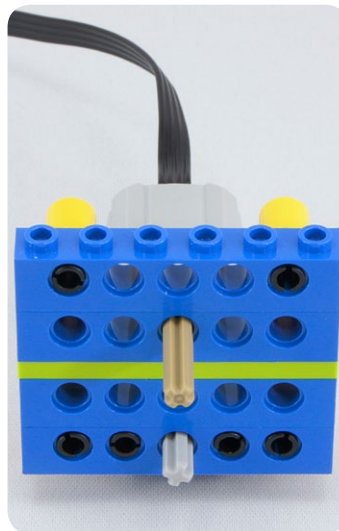
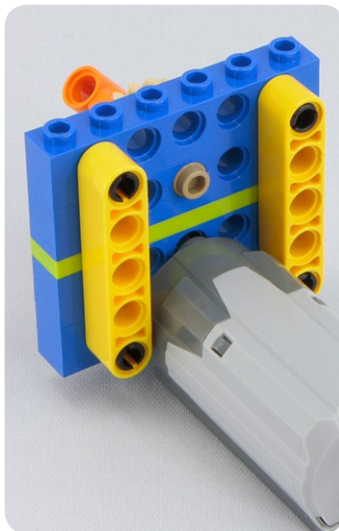
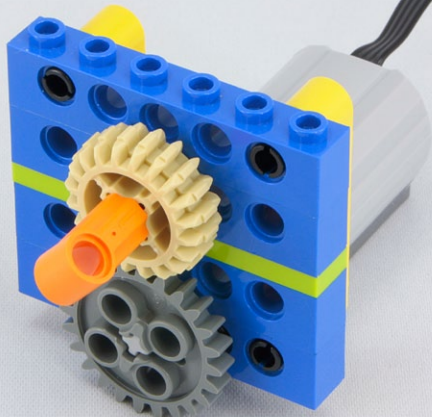
$24:20 = 6:5 \triangleright 1.20$



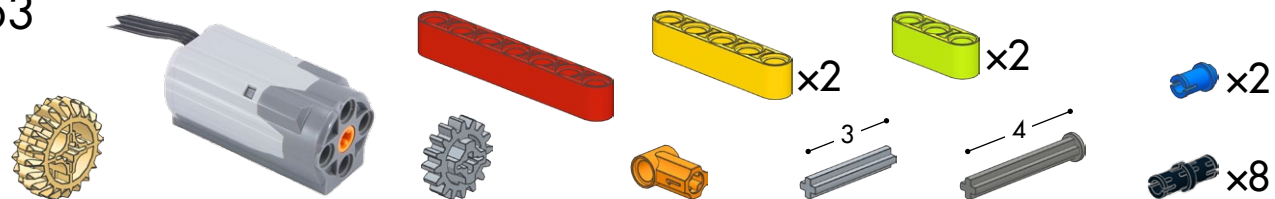
#52



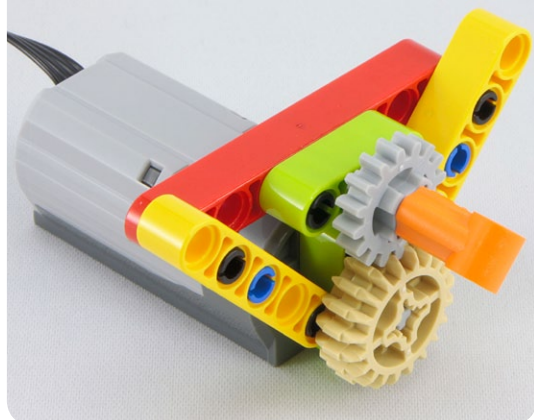
$24:20 = 6:5 \rightarrow 1.20$



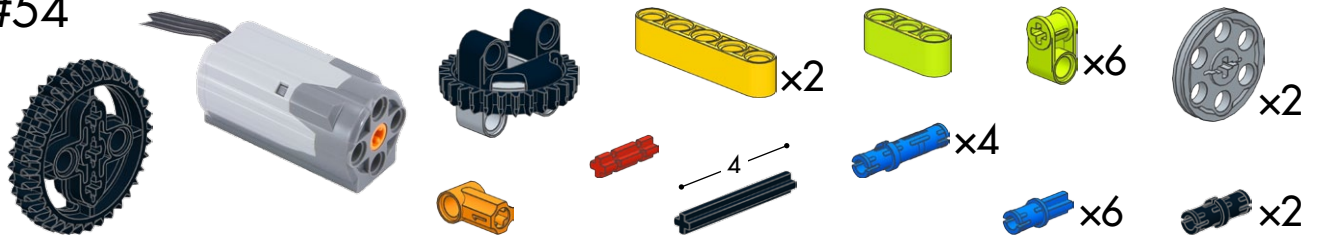
#53



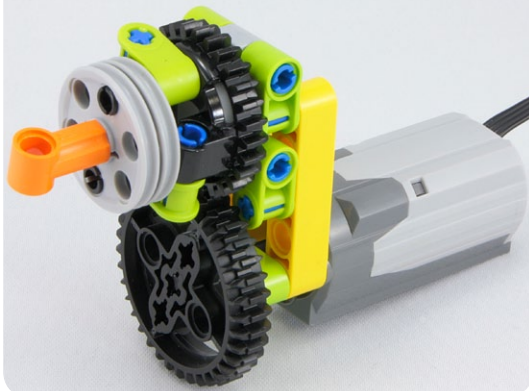
$20:16 = 5:4 \rightarrow 1.25$



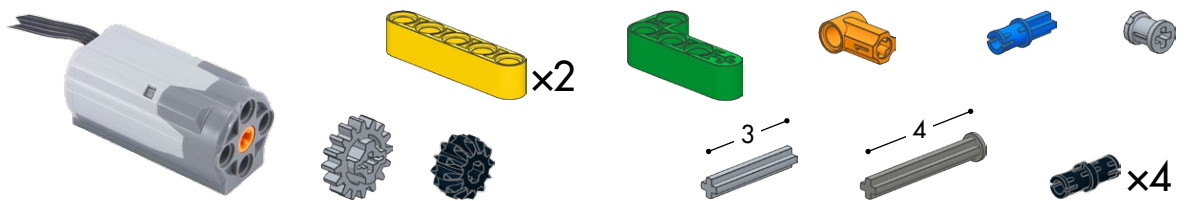
#54



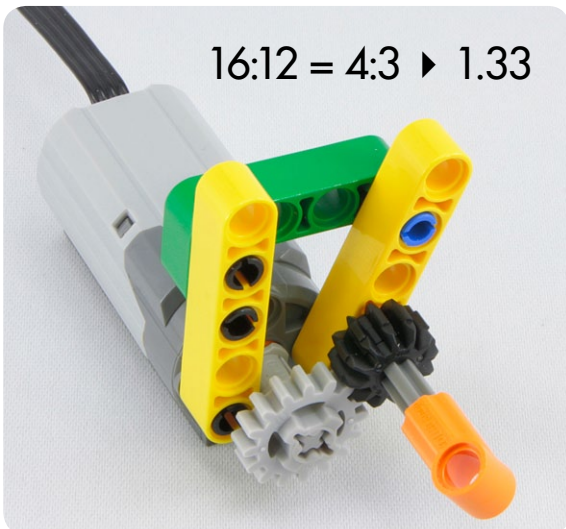
$36:28 = 9:7 \triangleright 1.29$



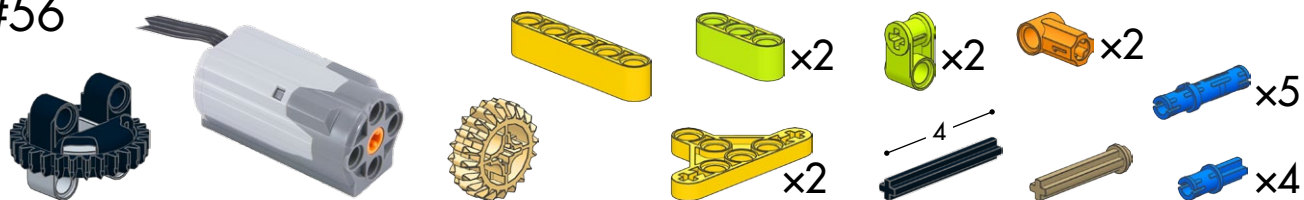
#55



$16:12 = 4:3 \triangleright 1.33$



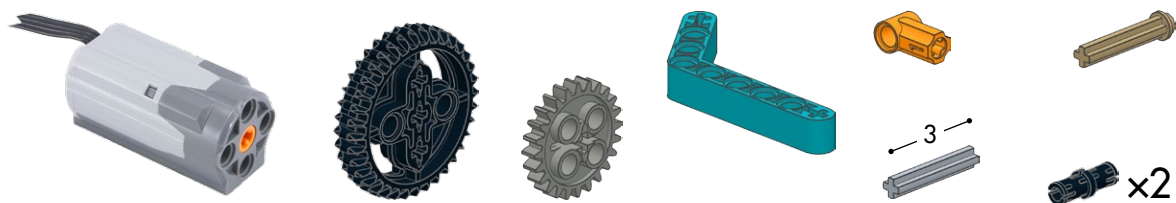
#56



$28:20 = 7:5 \rightarrow 1.40$



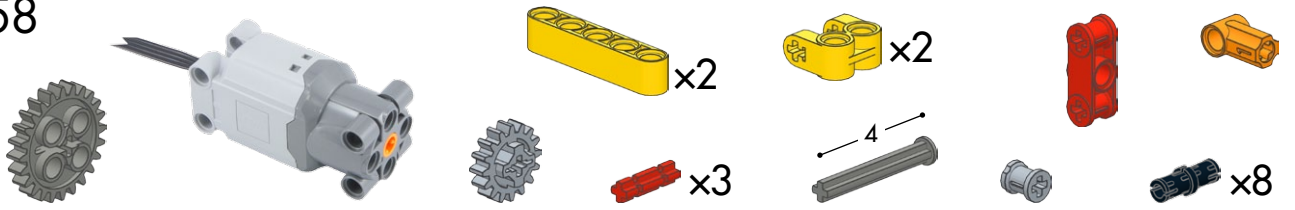
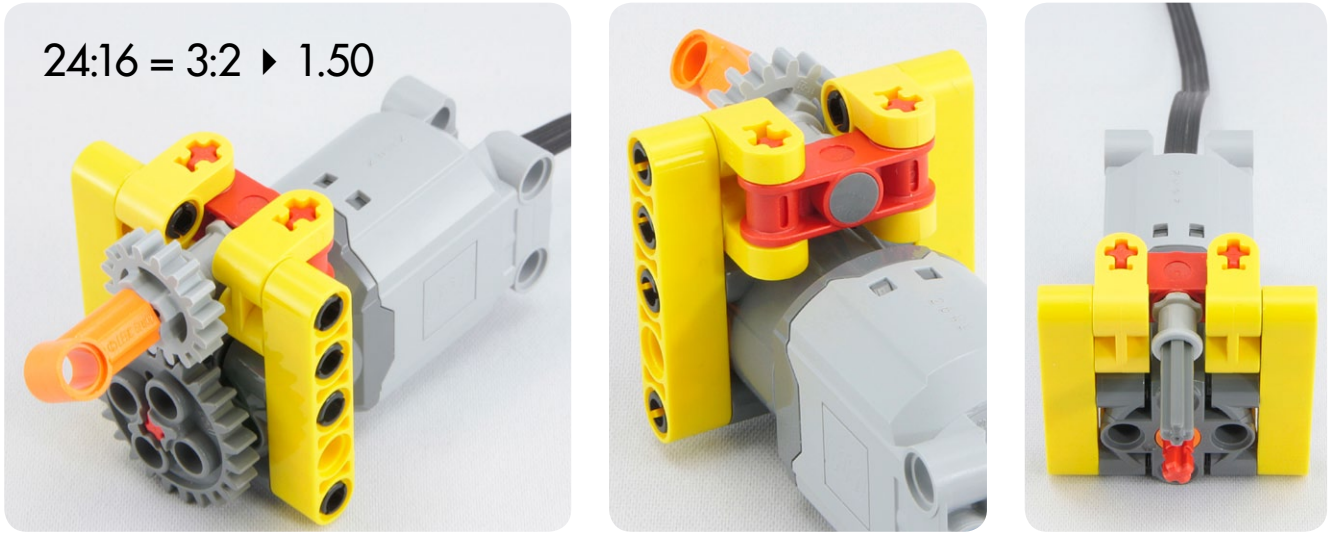
#57



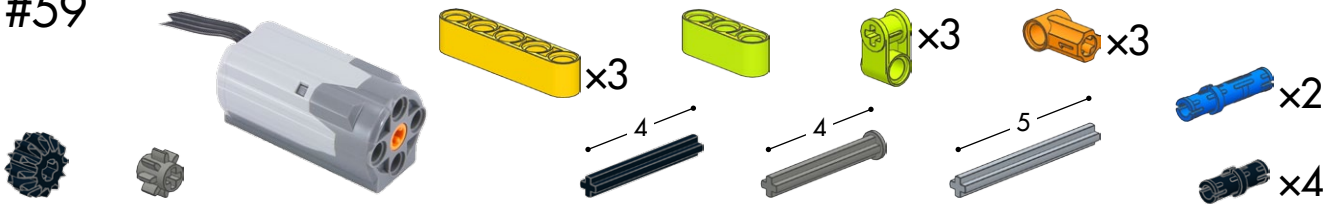
$36:24 = 3:2 \rightarrow 1.50$



#58

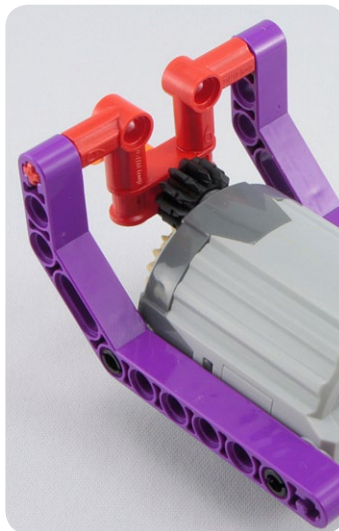

$$24:16 = 3:2 \blacktriangleright 1.50$$


#59


$$12:8 = 3:2 \blacktriangleright 1.50$$


#60

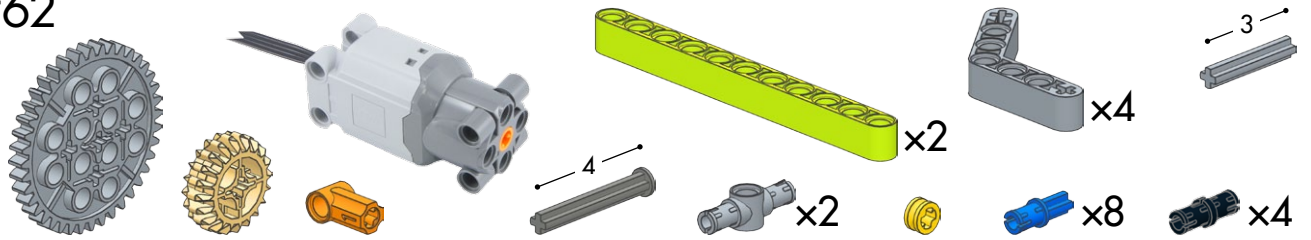
1 yellow gear, 1 grey motor, 1 black gear, 2 purple 1x5 Technic beams, 2 red 1x3 L-shaped Technic connectors, 2 red 1x3 Technic connectors, 5 red 1x2 Technic connectors, 4 black 1x4 Technic axles, 4 black 1x2 Technic pins, and 1 yellow 1x2 Technic connector.

[illegible]

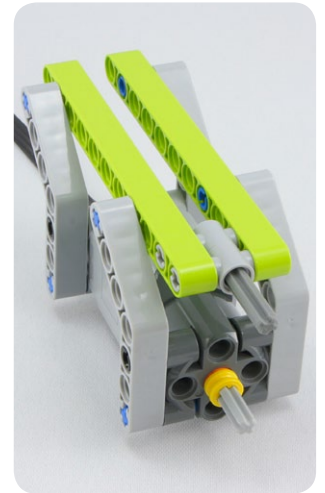
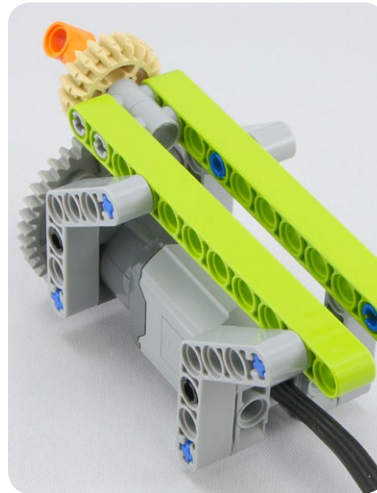
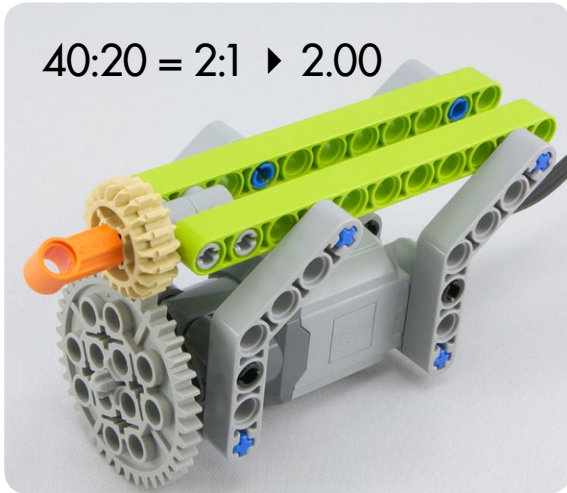
36:20 = 9:5 ► 1.80

A photograph of a LEGO Technic assembly. It features a grey motor block connected to a black cable. A grey Technic beam is attached to the motor, with a yellow pin and a blue pin visible. A yellow gear is mounted on the motor's axle, which is connected to a larger black gear. An orange pin is also visible on the assembly.

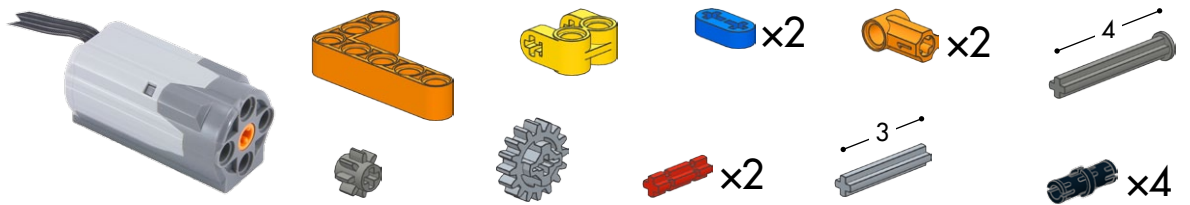
#62



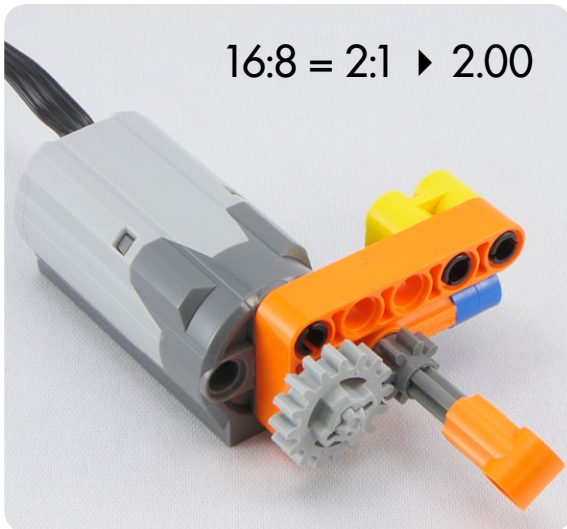
$40:20 = 2:1 \rightarrow 2.00$



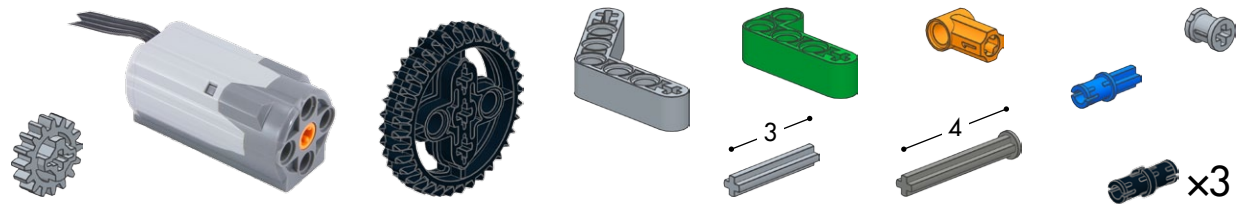
#63



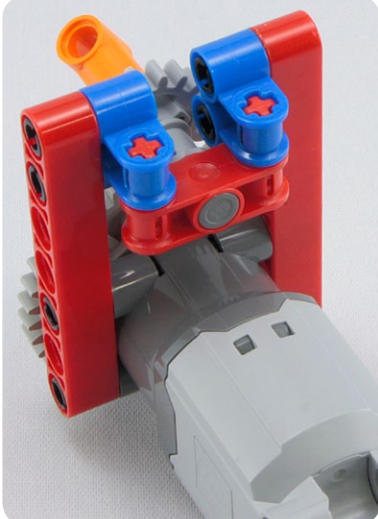
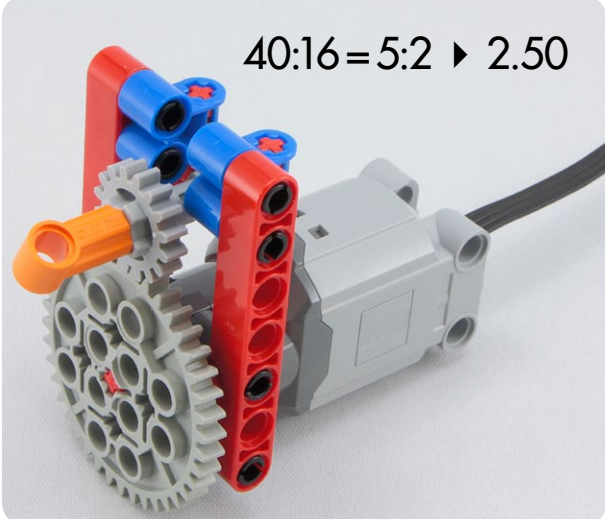
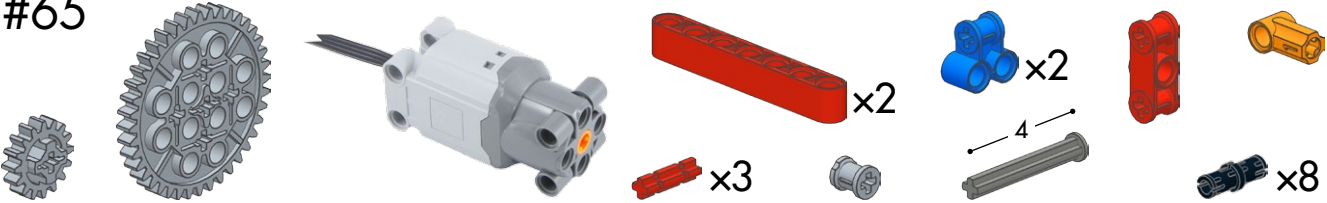
$16:8 = 2:1 \rightarrow 2.00$



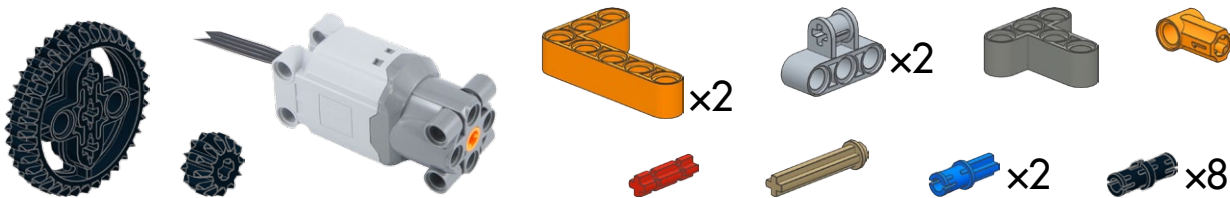
#64



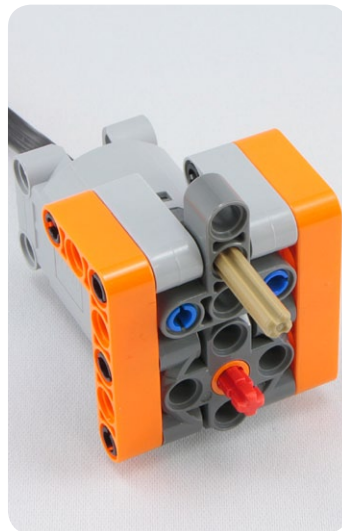
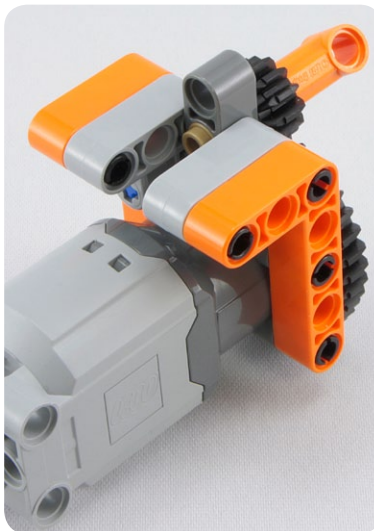
#65



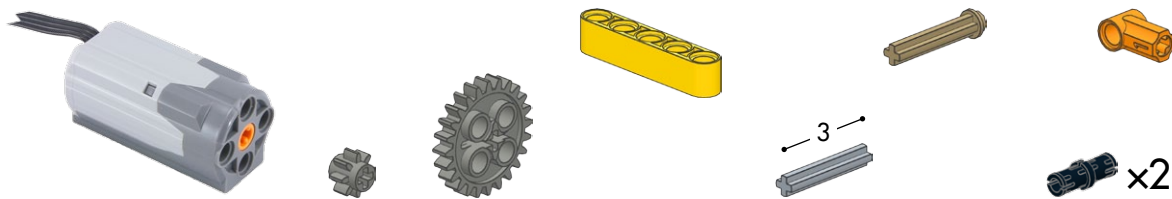
#66



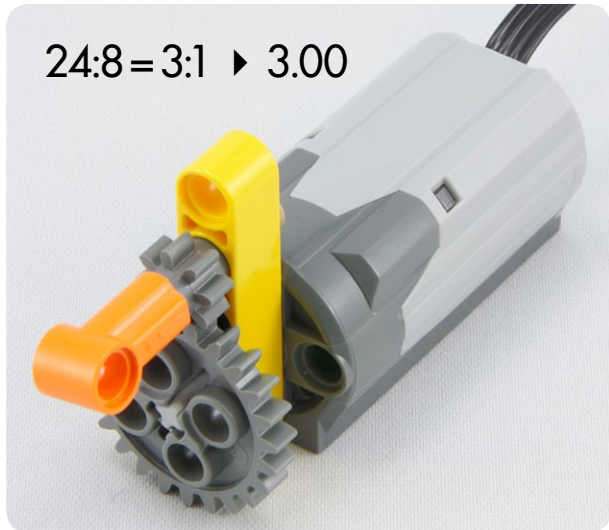
$36:12 = 3:1 \rightarrow 3.00$



#67



$24:8 = 3:1 \rightarrow 3.00$



#68



Parts list for step 68:

- 2 x 12-tooth grey gear
- 1 x 12-tooth grey gear
- 1 x 12-tooth black gear
- 1 x 4 x 1 black axle
- 1 x 4 x 1 tan axle
- 1 x 4 x 1 orange Technic beam
- 1 x 1 x 1 grey axle connector
- 1 x 1 x 1 orange axle connector
- 1 x 1 x 1 blue axle connector
- 3 x 1 x 1 black axle connector

40:12 = 10:3 ► 3.33

A photograph of a LEGO Technic assembly. It features a grey motor connected to a grey 40-tooth gear. The gear is mounted on a black axle, which is also connected to a smaller grey gear. An orange Technic pin is visible on the axle. The assembly is shown against a white background.

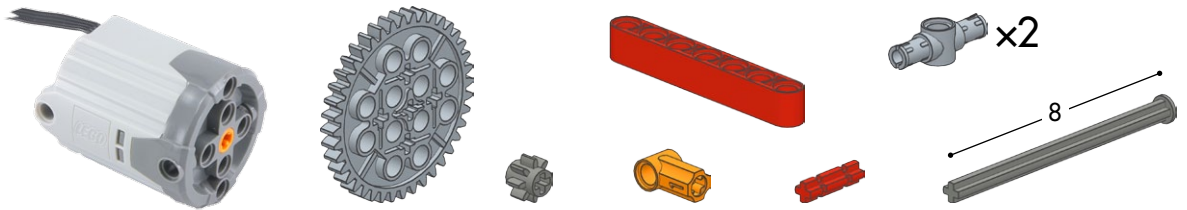
#69

1 grey motor, 1 black gear, 1 grey L-shaped beam, 1 tan axle, 1 orange connector, 1 grey axle with 3 pins, 1 grey small gear, and 2 black connectors.

36:8 = 9:2 ▶ 4.50

A close-up photograph of a LEGO Technic motor assembly. The assembly consists of a grey motor housing, a black gear, and an orange connector. The gear is mounted on the motor's output shaft. The orange connector is attached to the gear's axle. The assembly is shown against a white background.

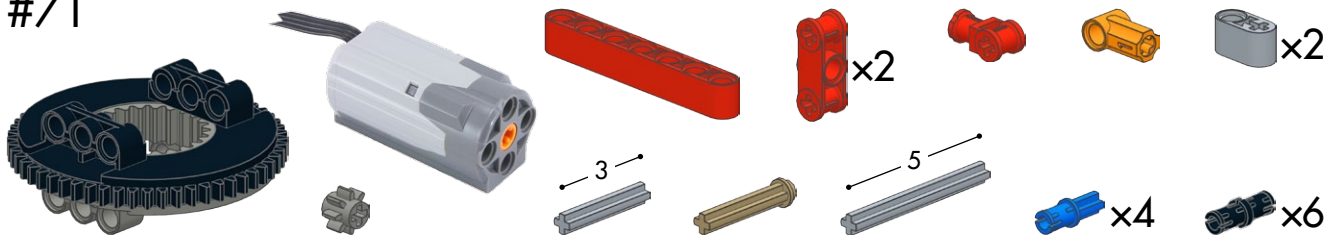
#70



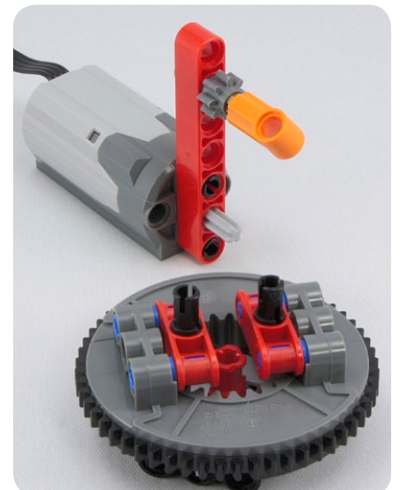
$40:8 = 5:1 \rightarrow 5.00$

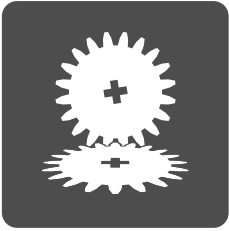


#71



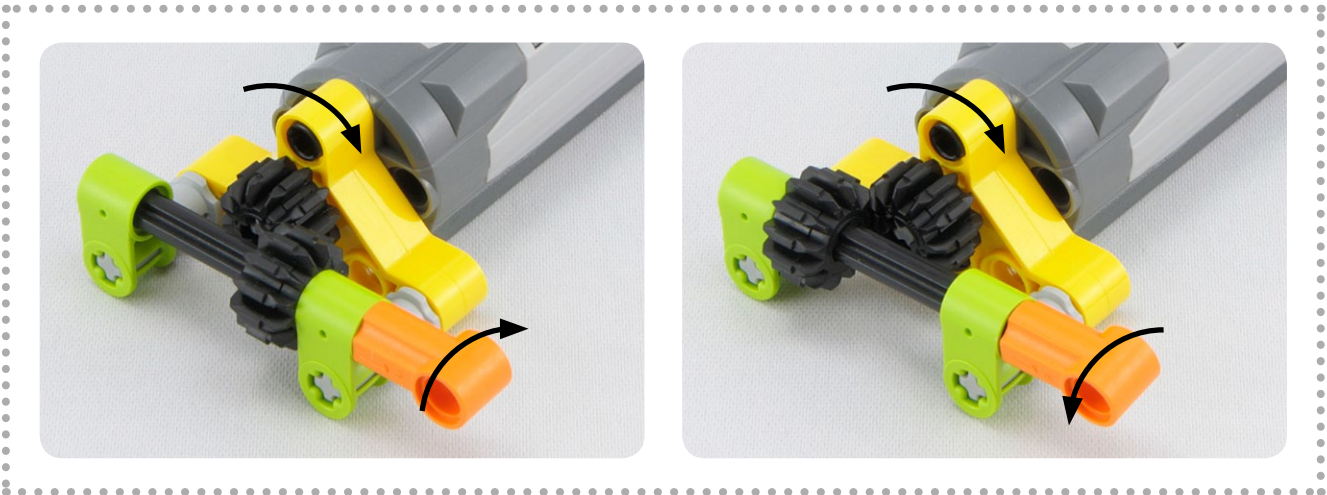
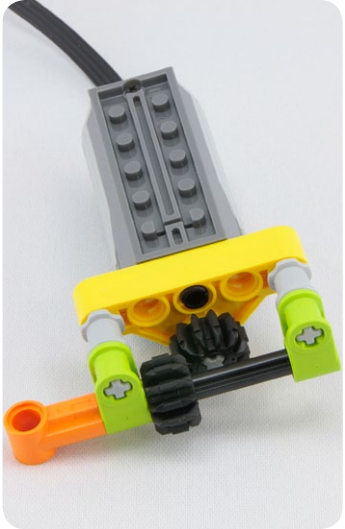
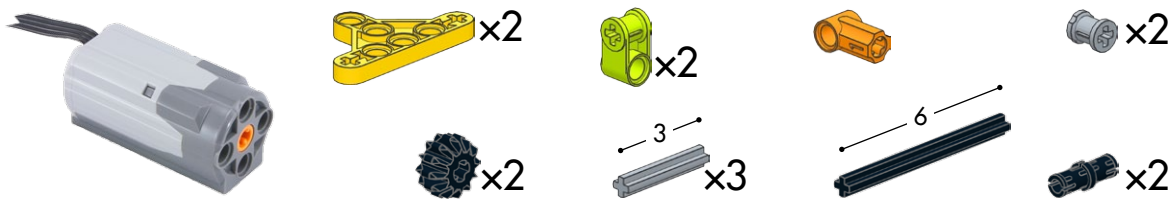
$56:8 = 7:1 \rightarrow 7.00$



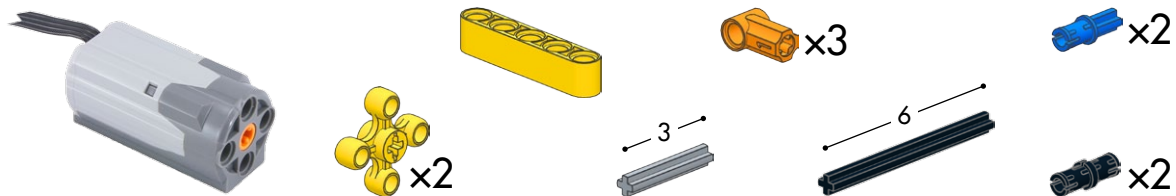


Changing the angle of rotation

#72



#73



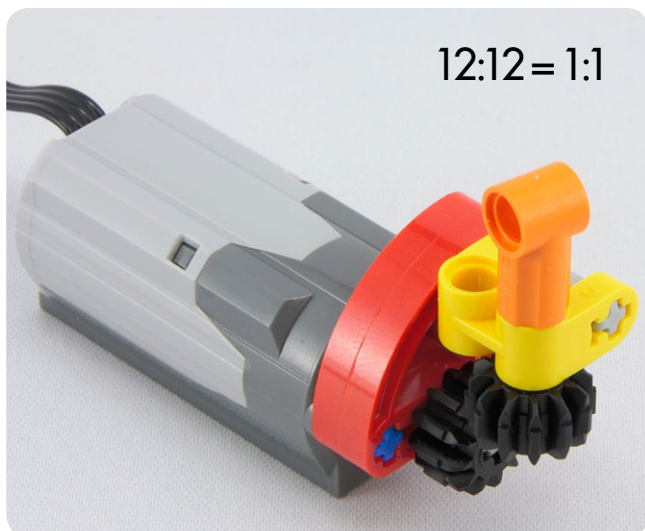
4:4 = 1:1



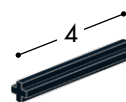
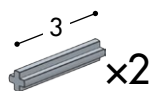
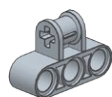
#74



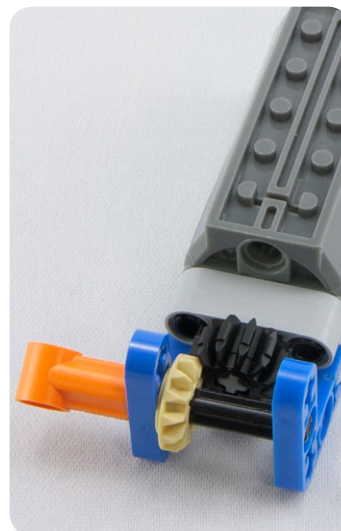
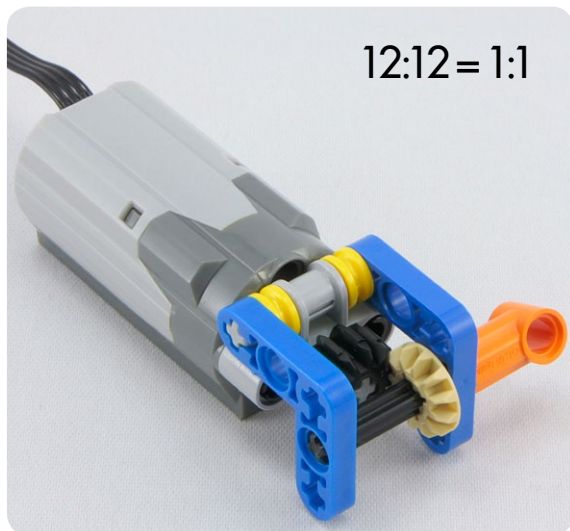
12:12 = 1:1



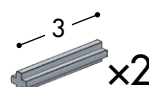
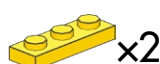
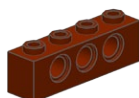
#75



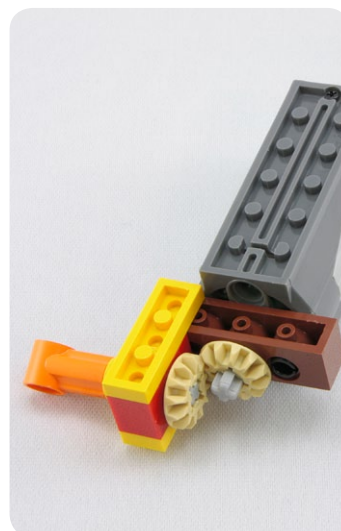
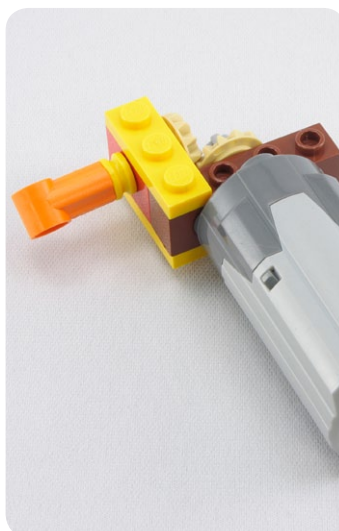
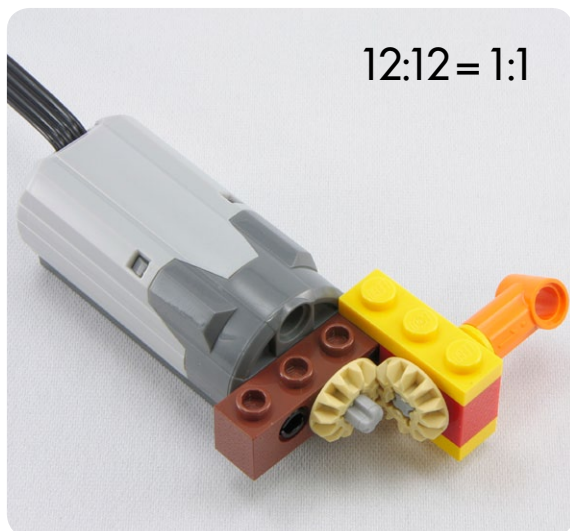
12:12 = 1:1



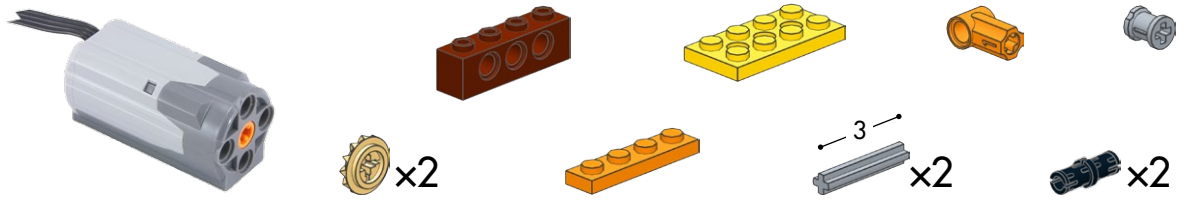
#76



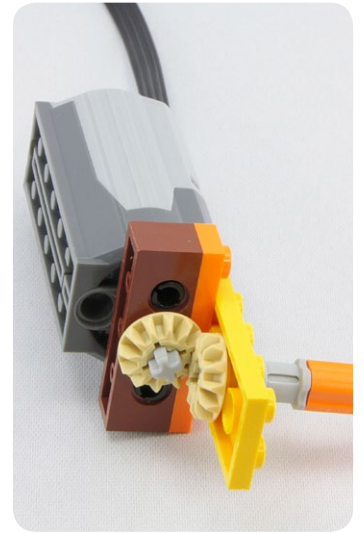
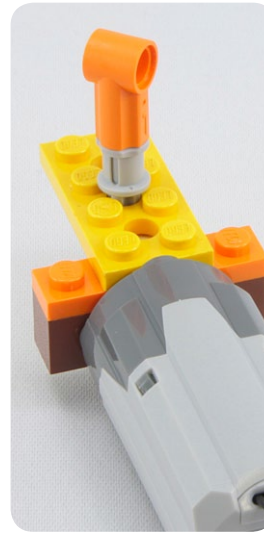
12:12 = 1:1



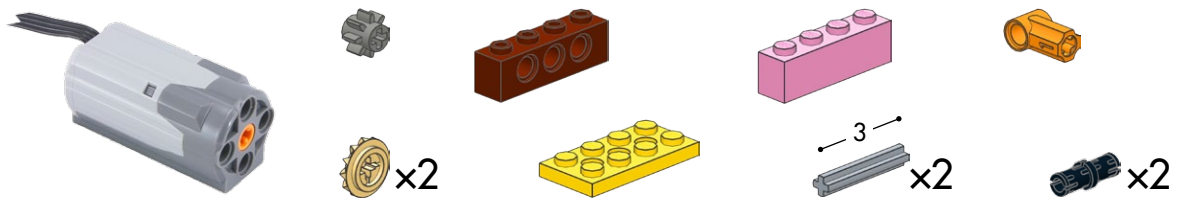
#77



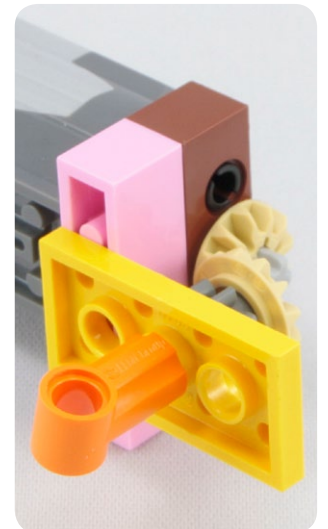
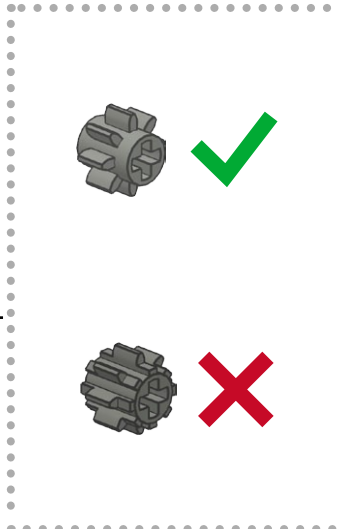
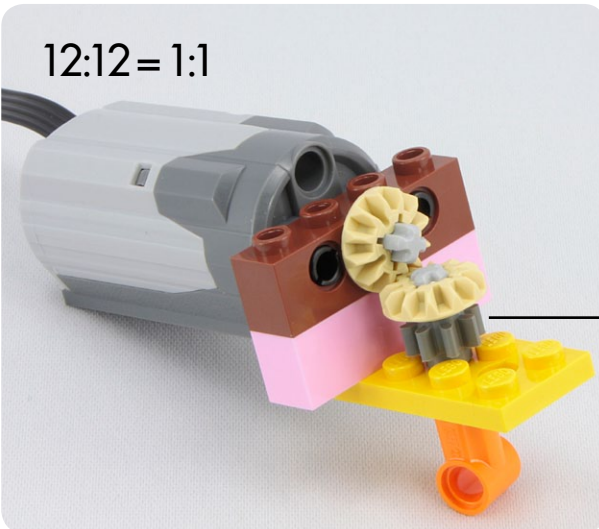
12:12 = 1:1



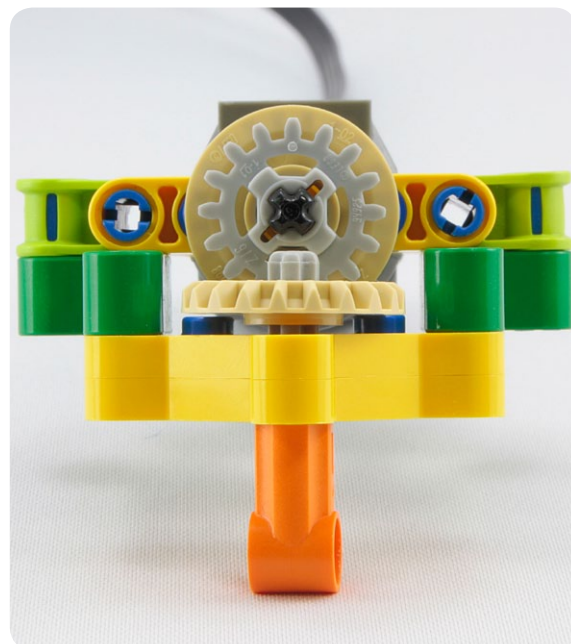
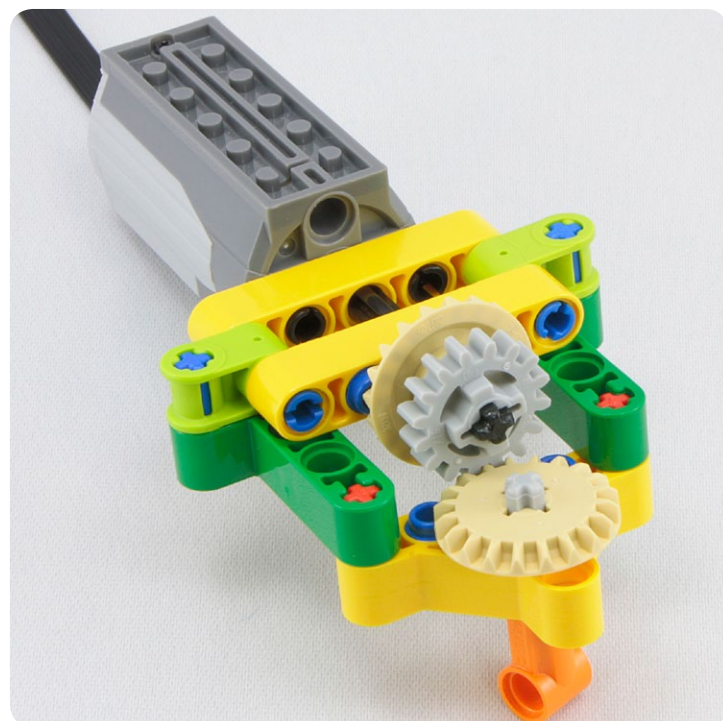
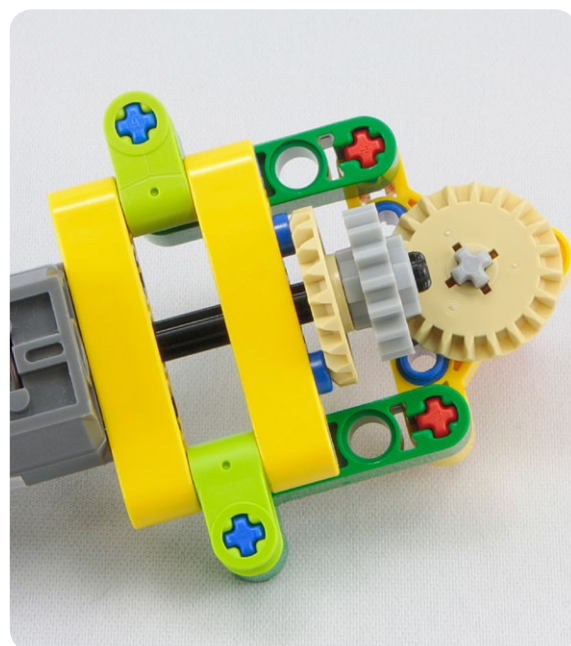
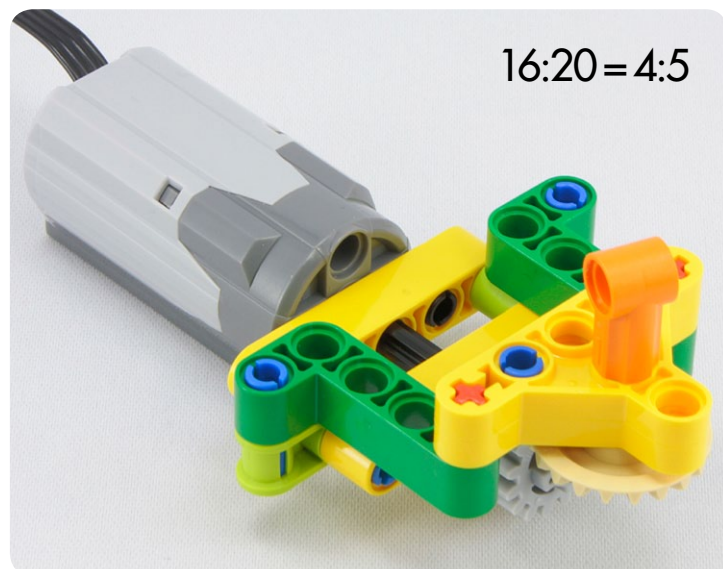
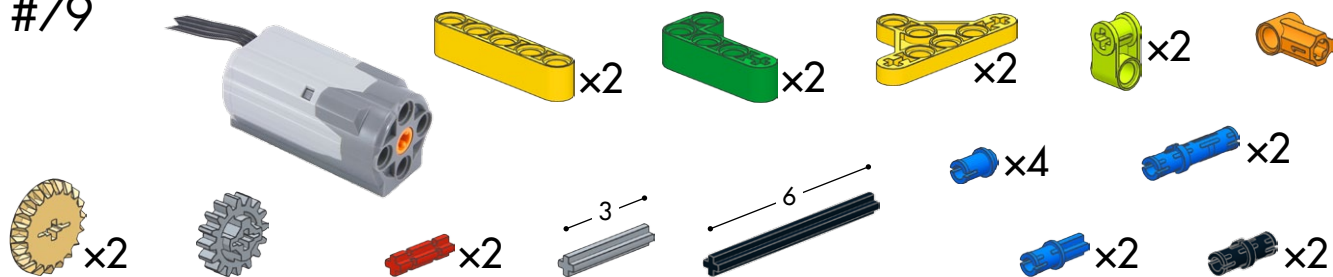
#78



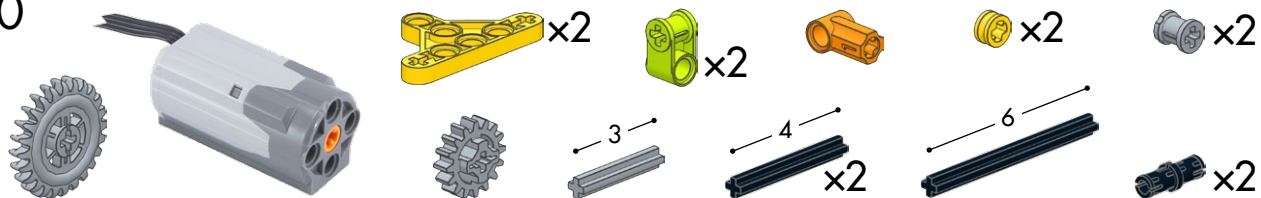
12:12 = 1:1



#79



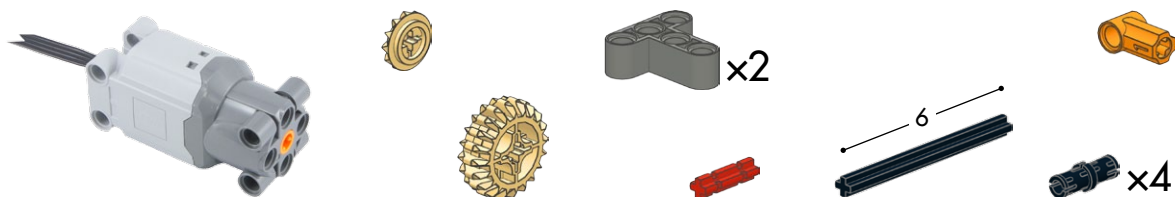
#80



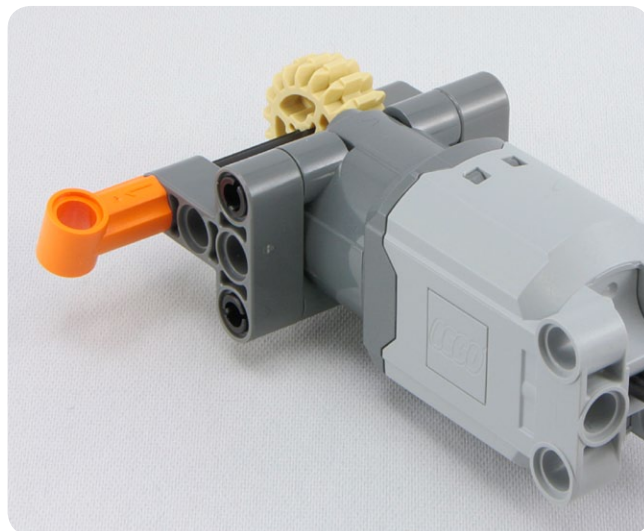
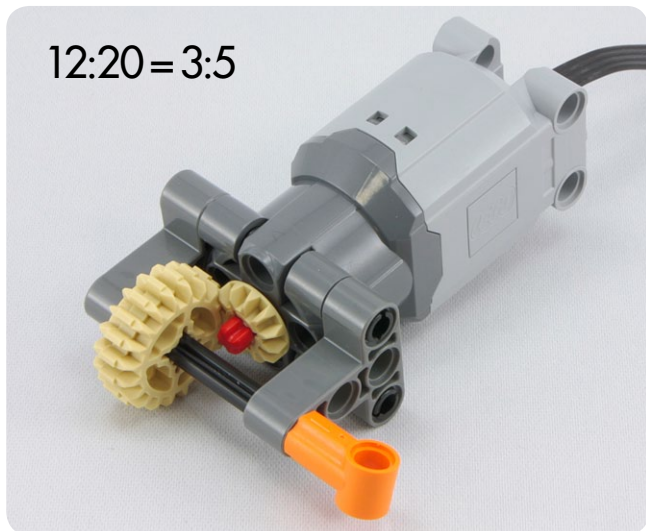
$16:24 = 2:3$



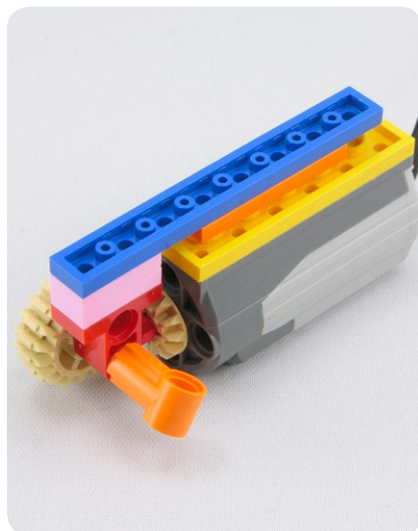
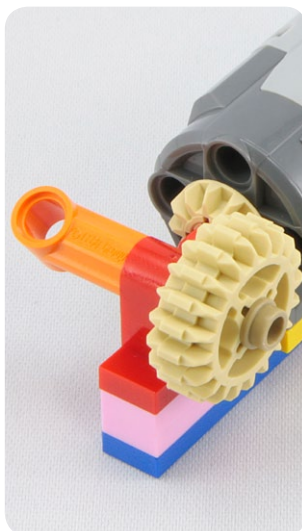
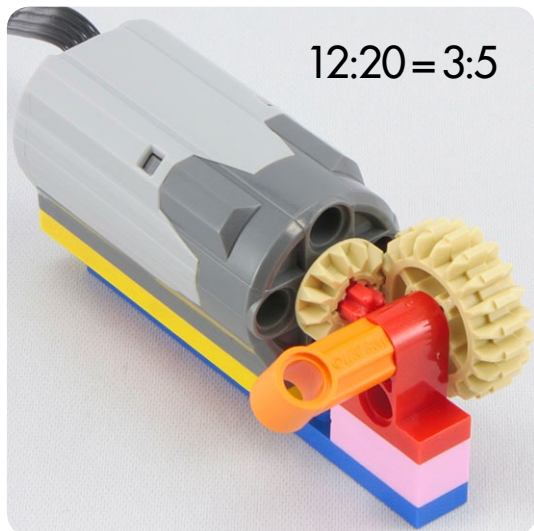
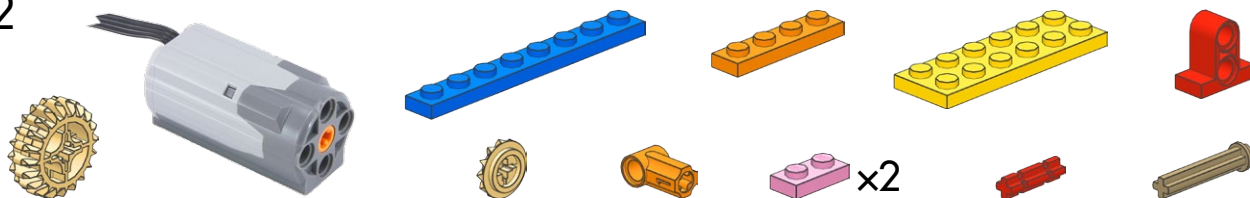
#81



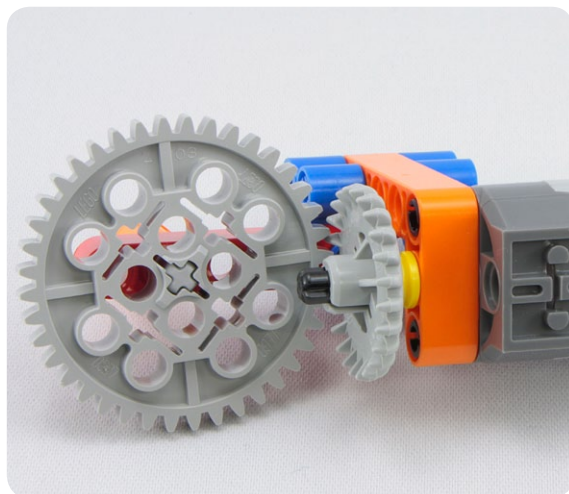
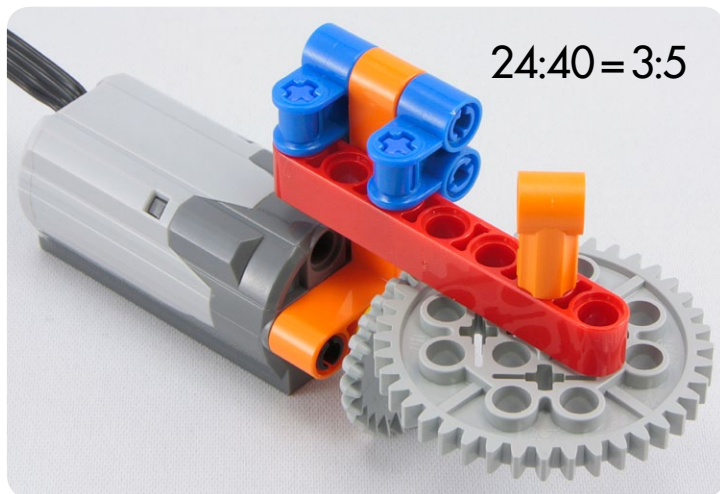
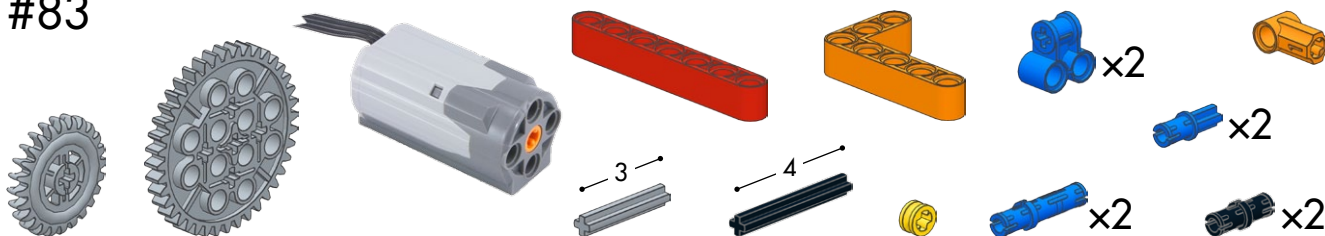
$12:20 = 3:5$



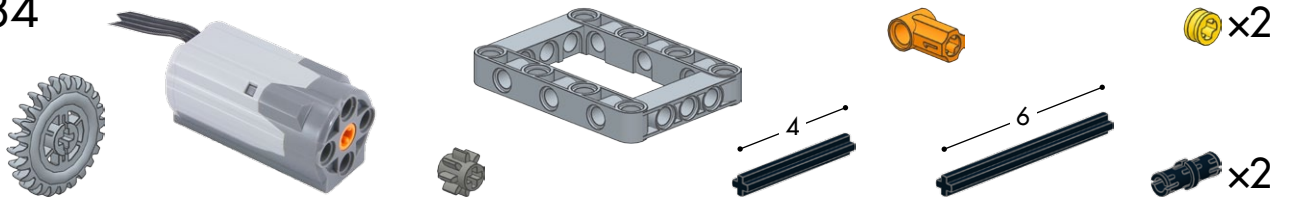
#82



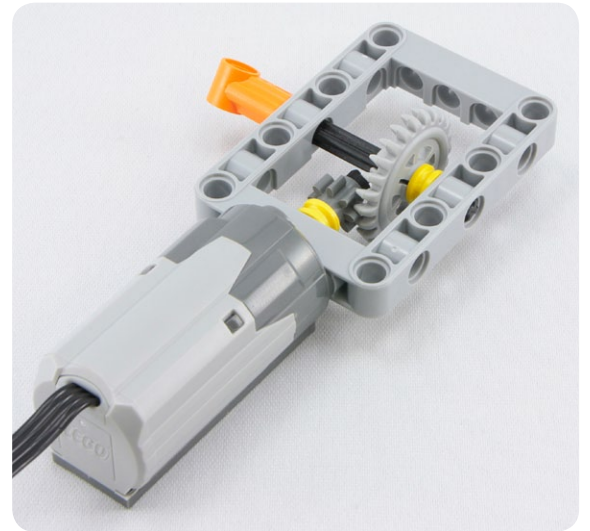
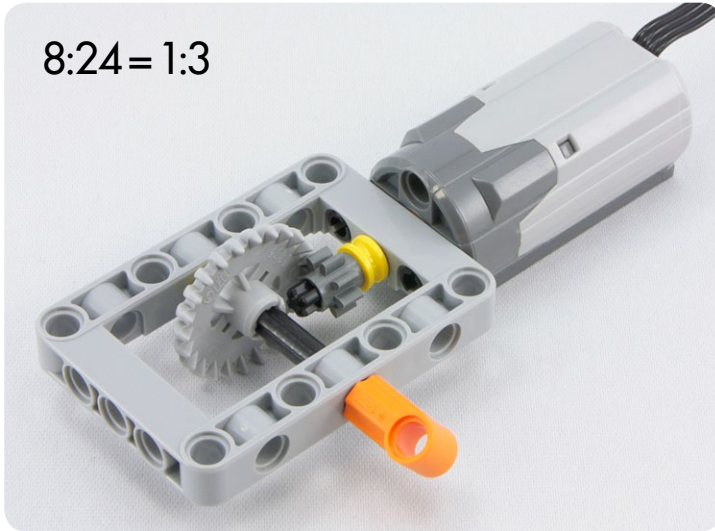
#83



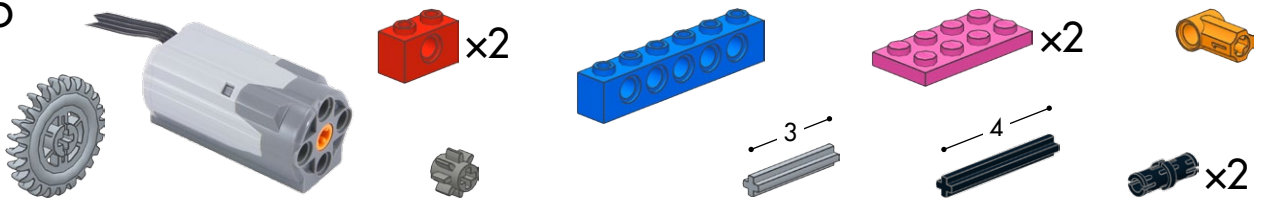
#84



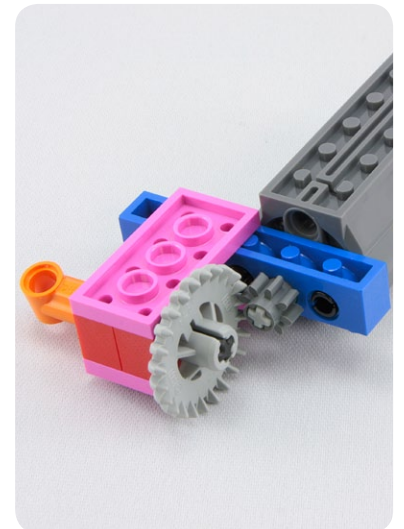
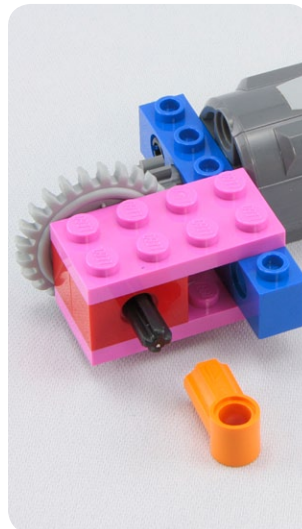
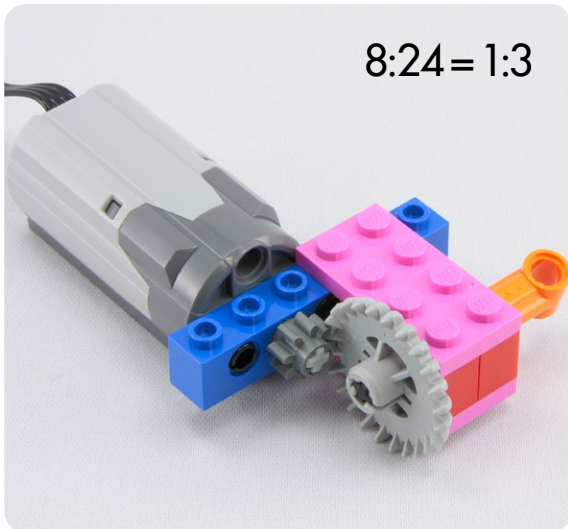
8:24 = 1:3



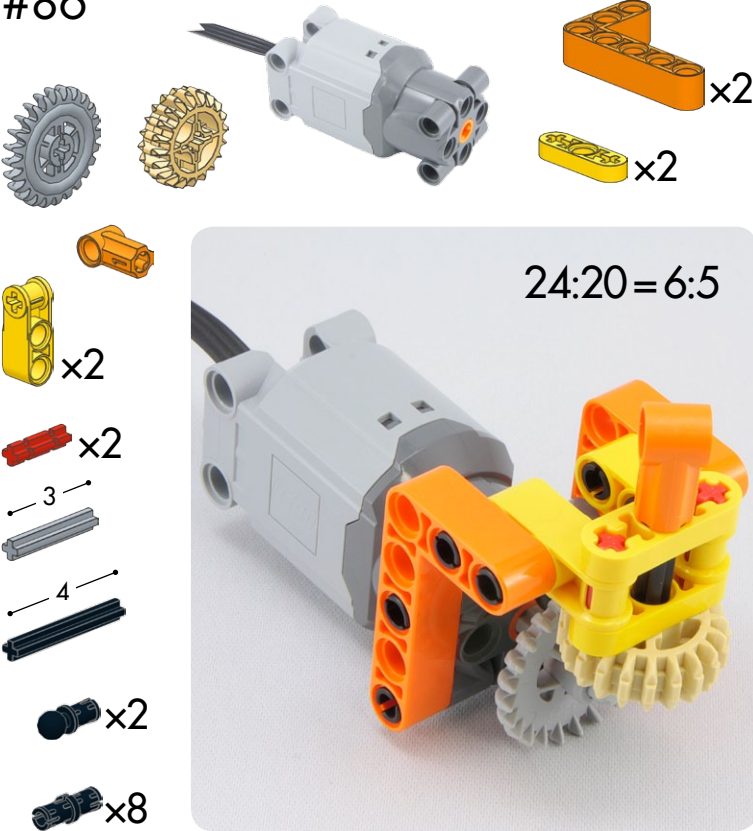
#85



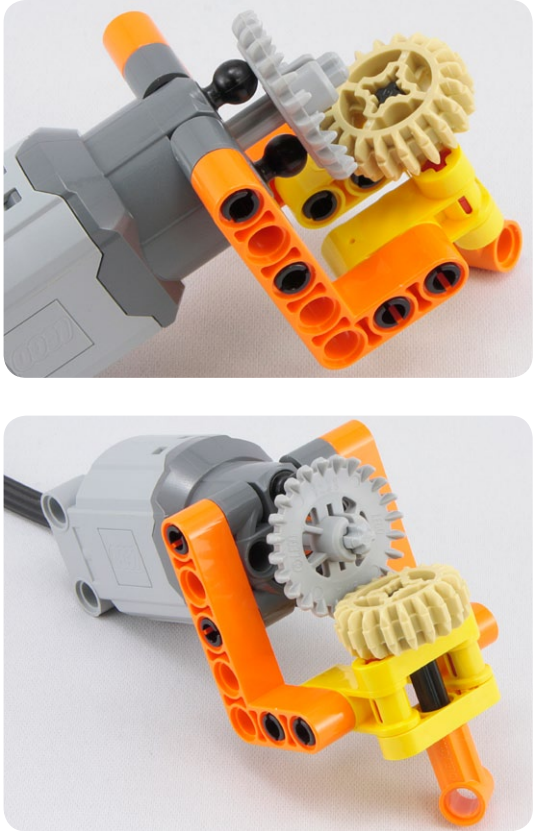
8:24 = 1:3



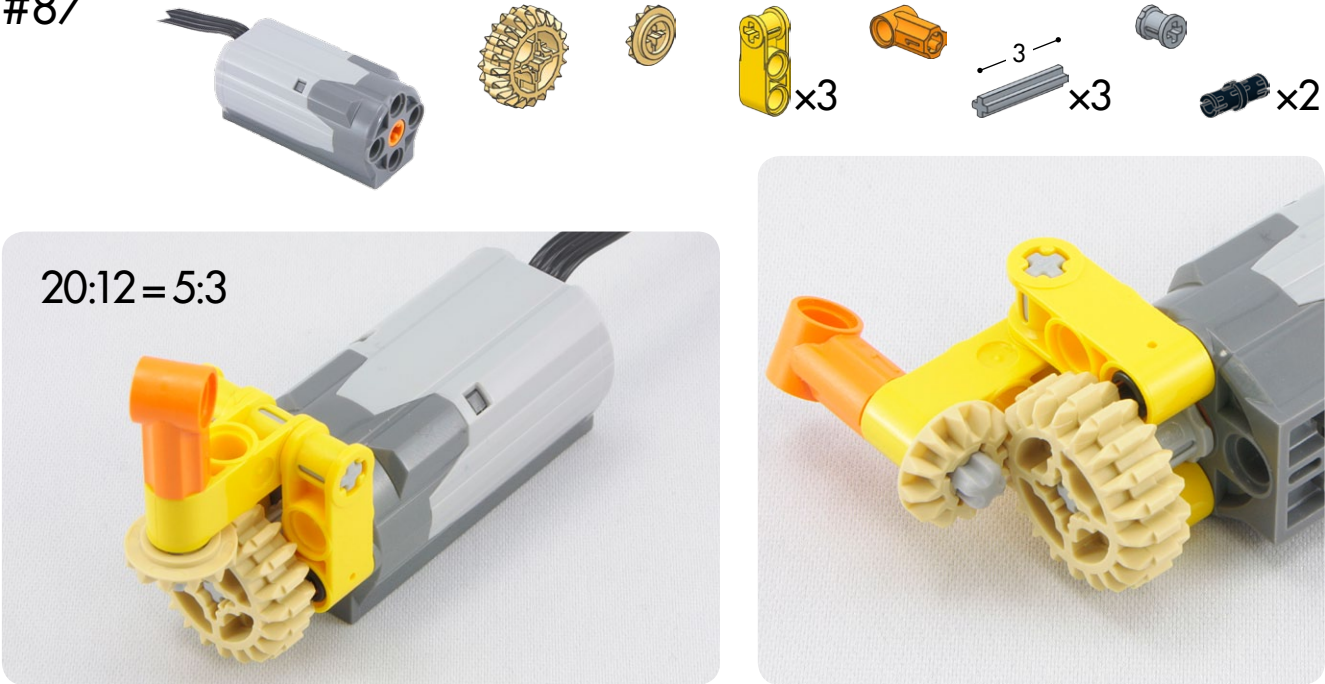
#86



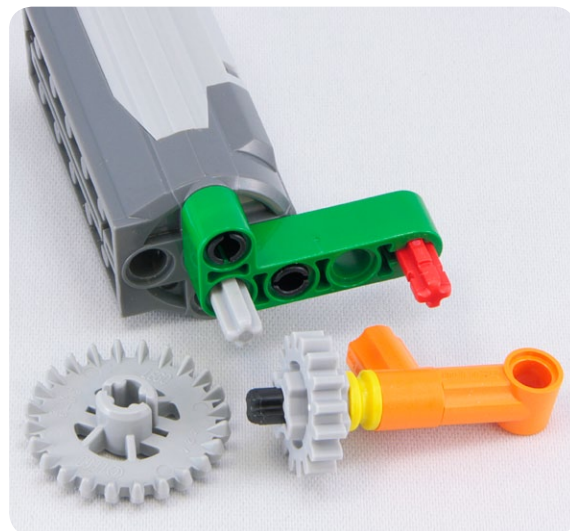
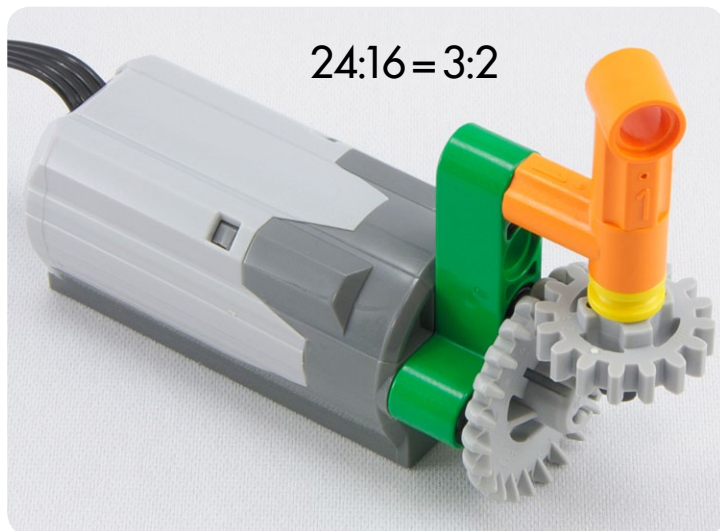
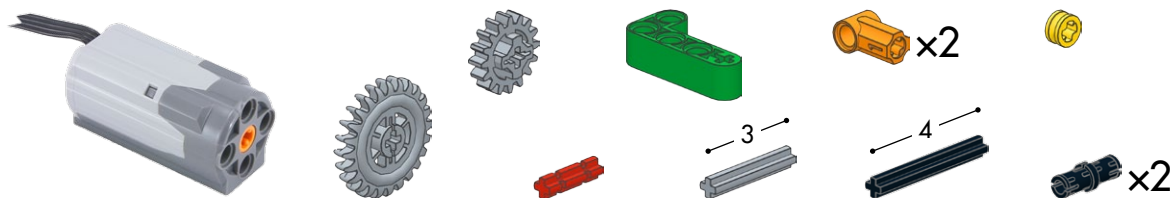
$24:20 = 6:5$



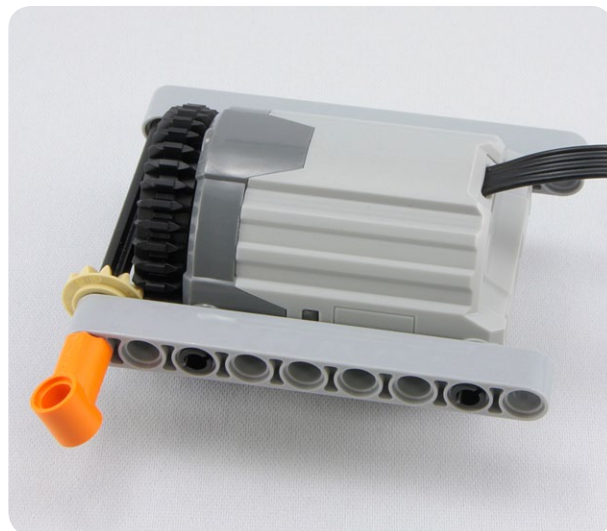
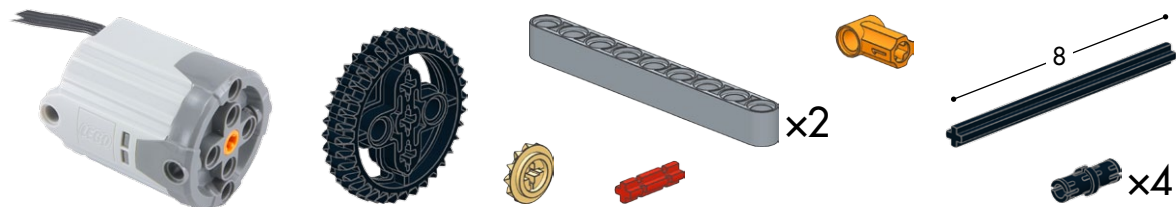
#87



#88



#89





$\times 2$



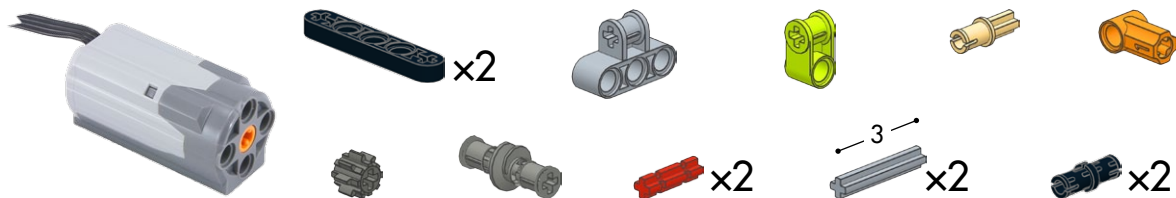
A diagram of a bar magnet with a length of 5 cm. The magnet is shown in perspective, with a dimension line above it indicating the length.

 $\times 2$

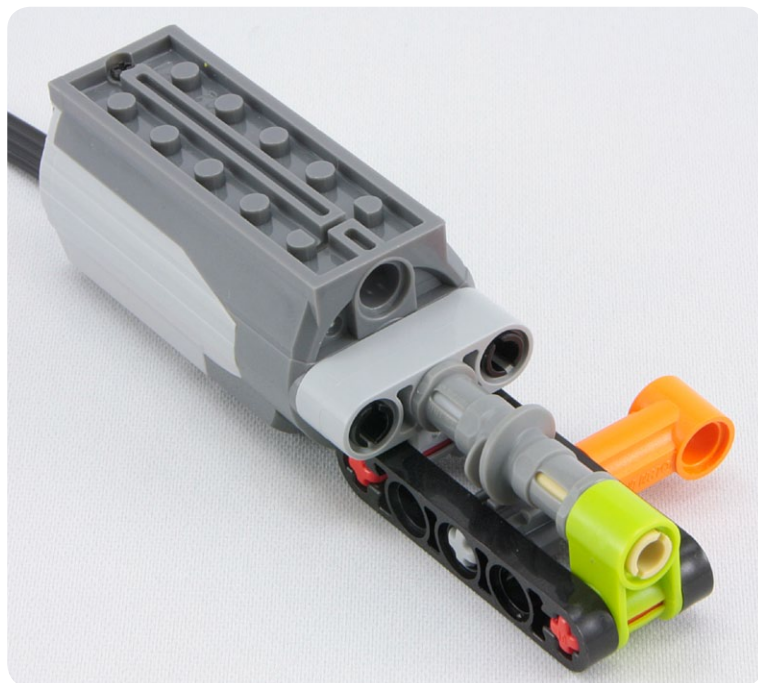
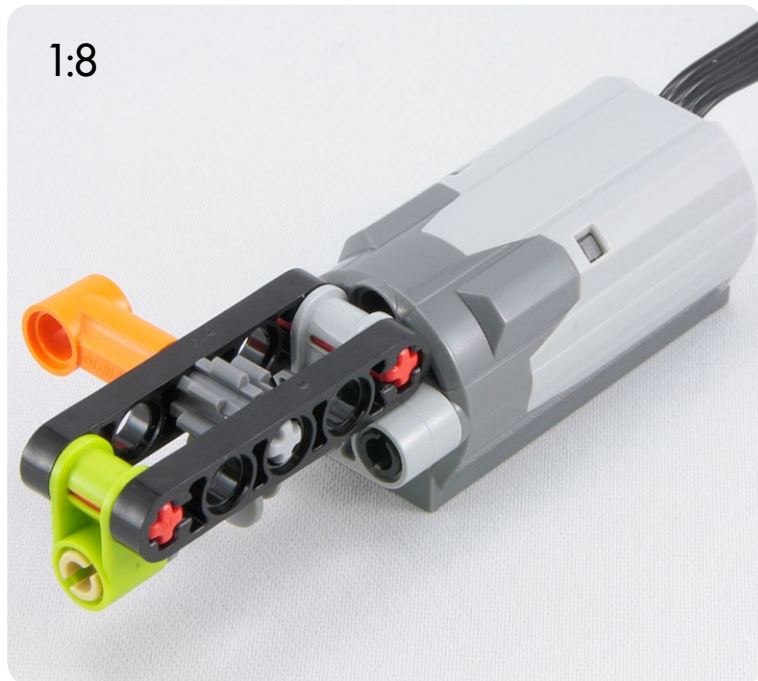
3

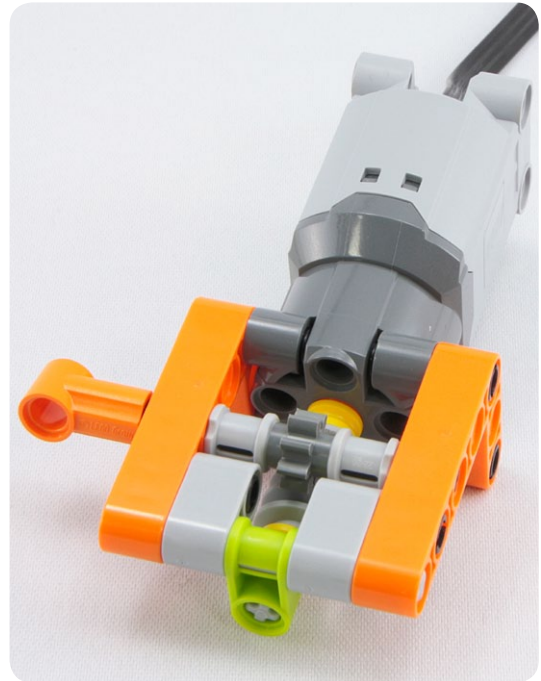
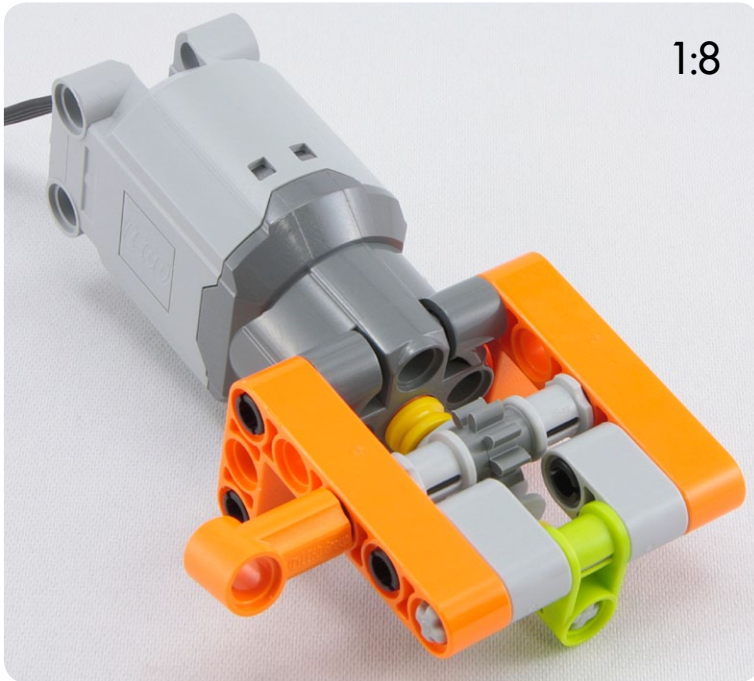


#91

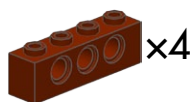


1:8

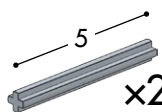


[illegible]

#93



x4

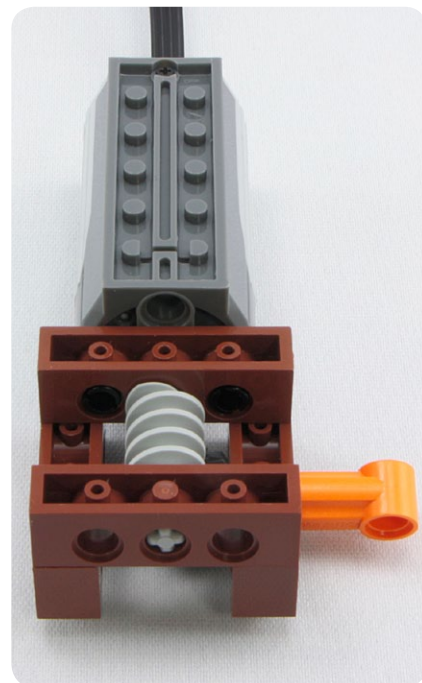
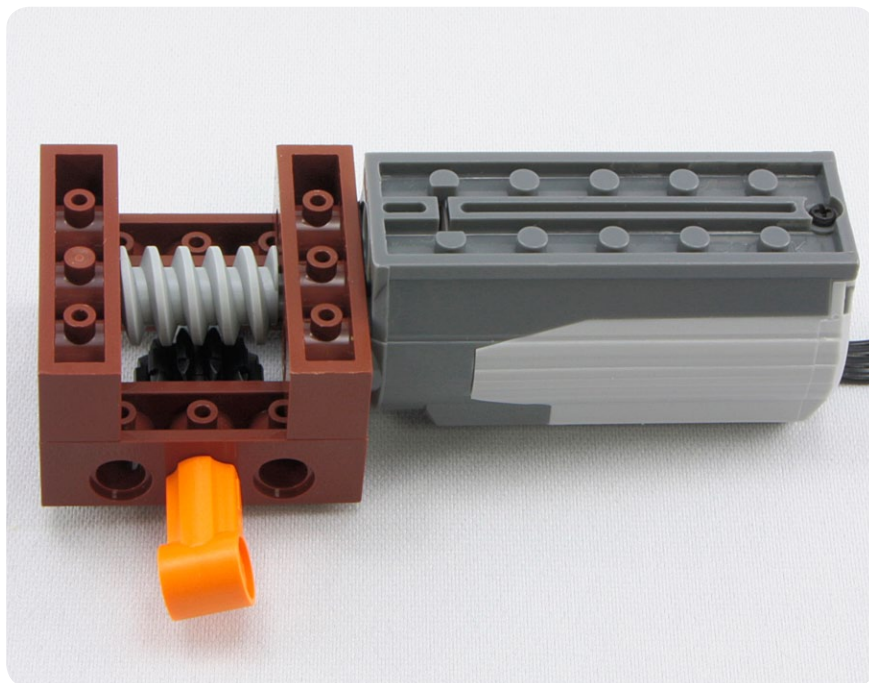
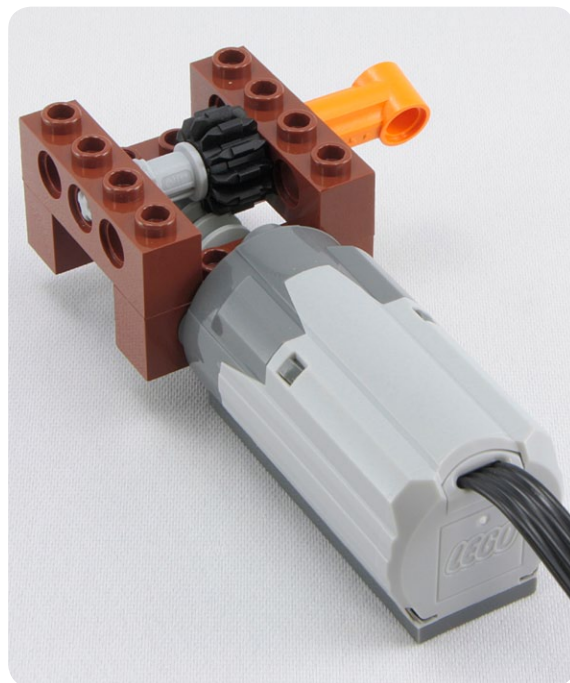
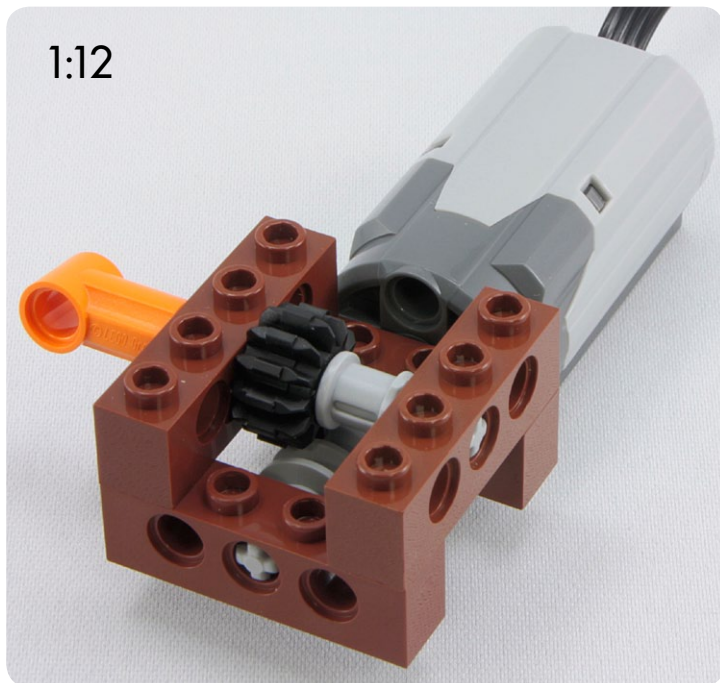


x2

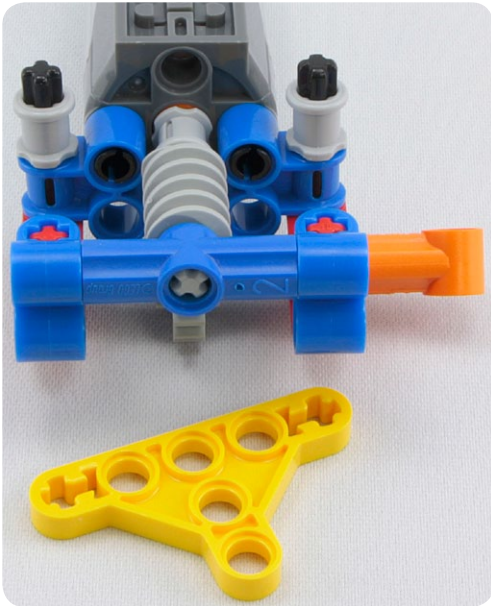
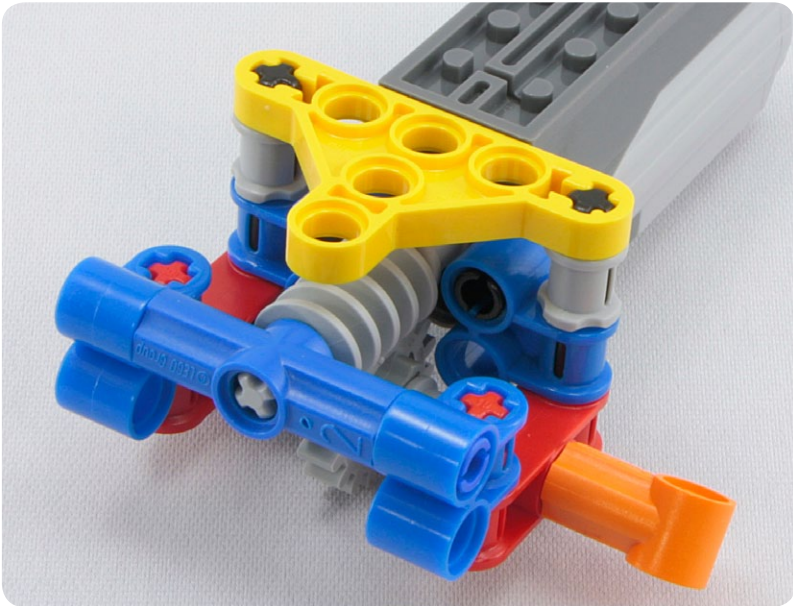
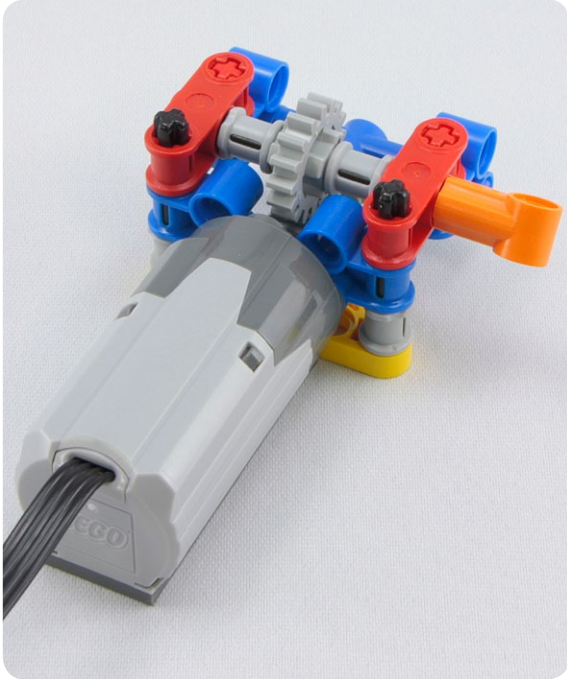
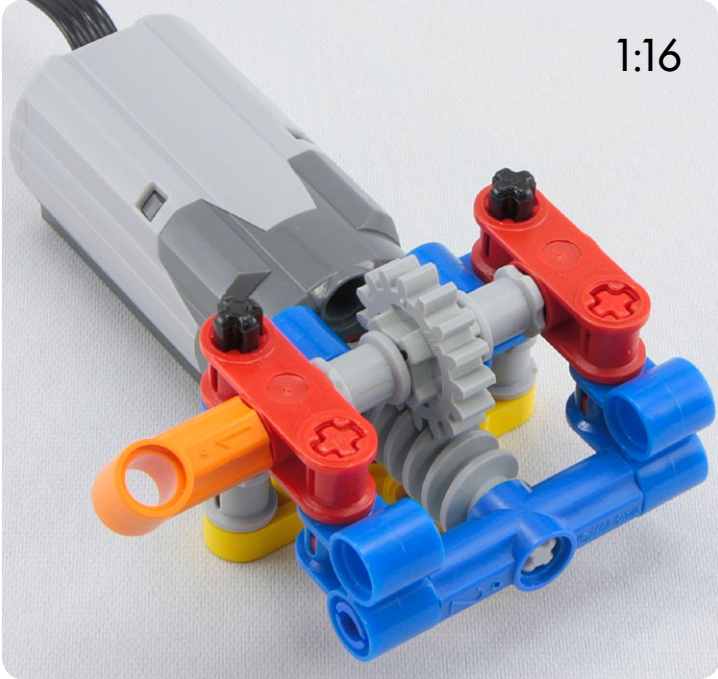
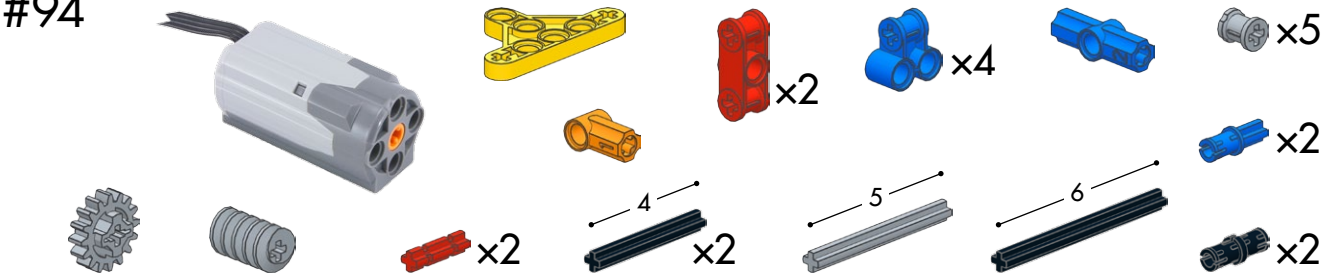


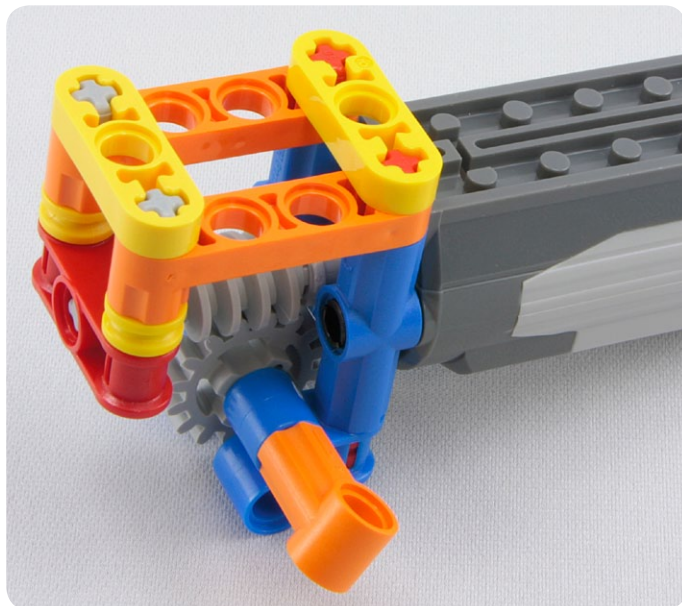
x2

1:12

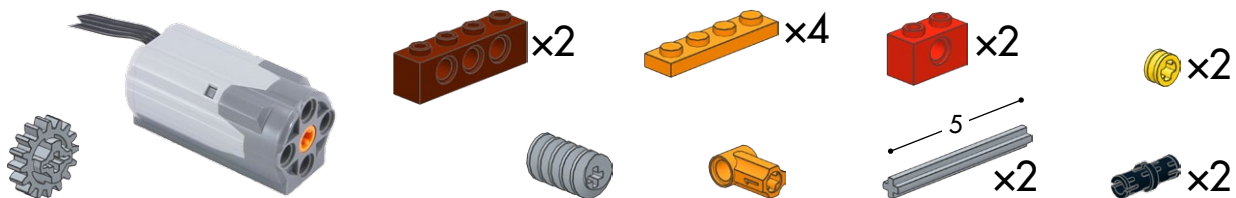


#94

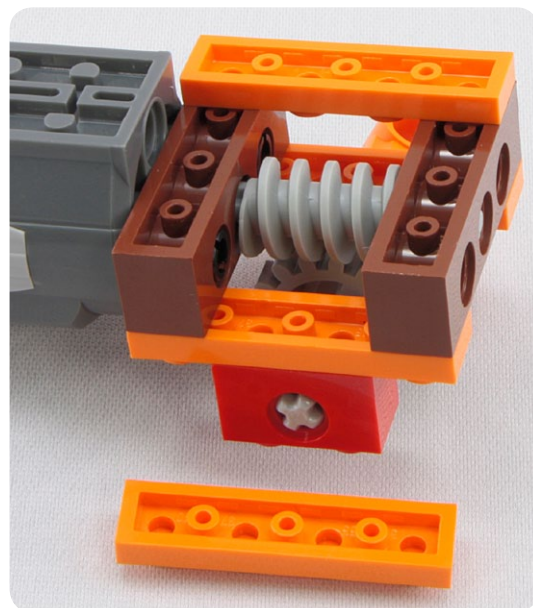
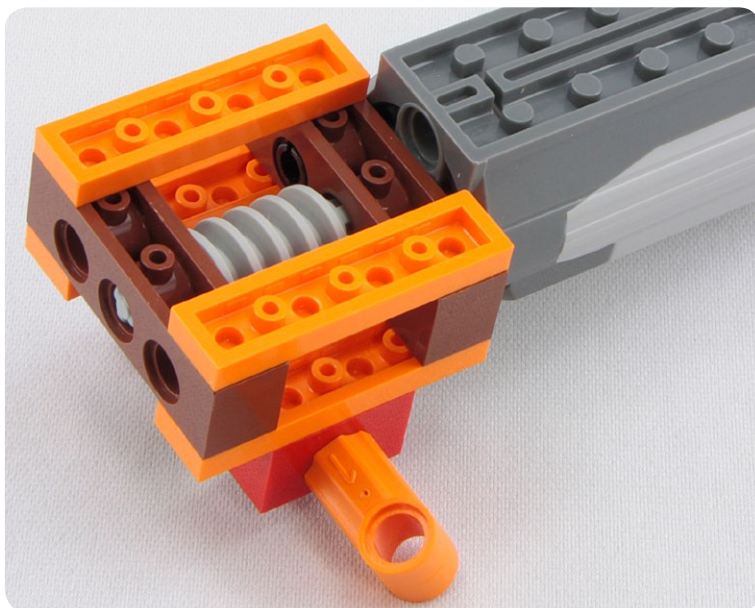
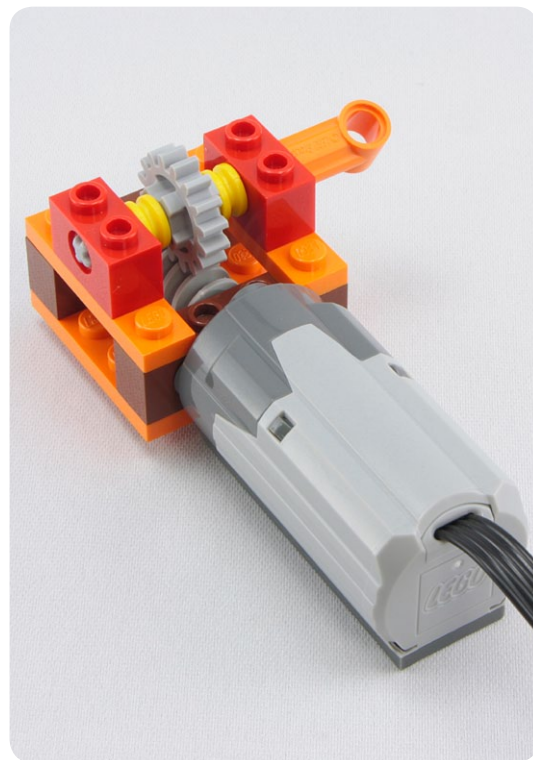
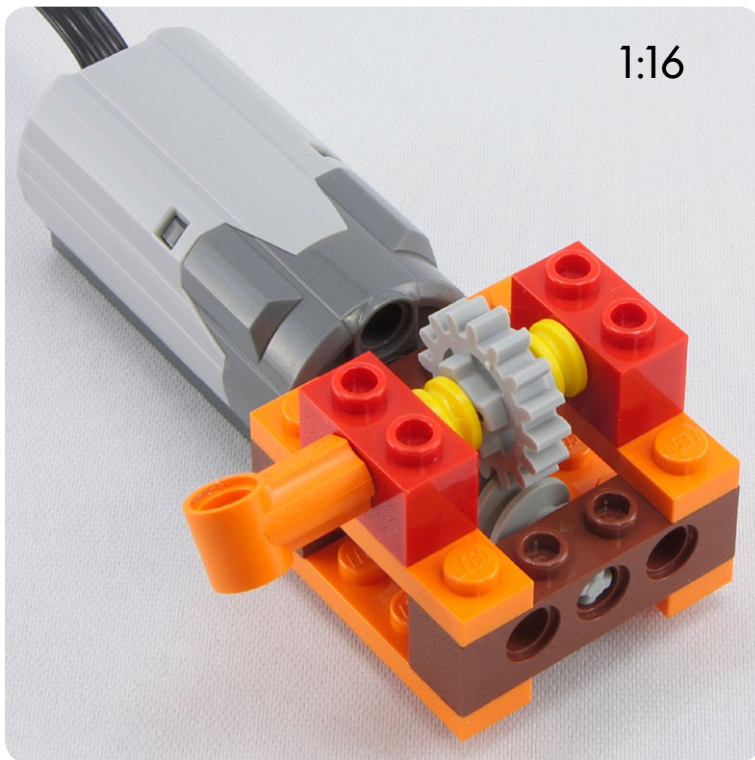


[illegible]

#96

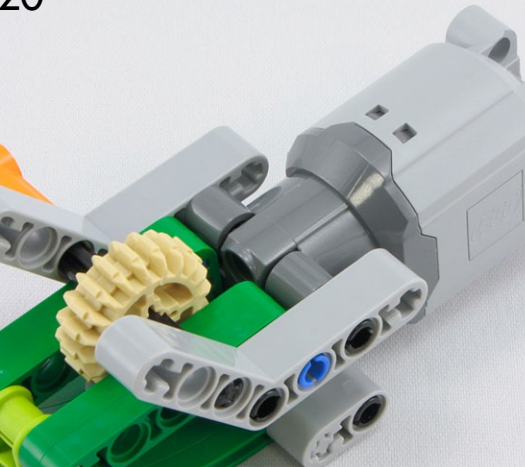


1:16

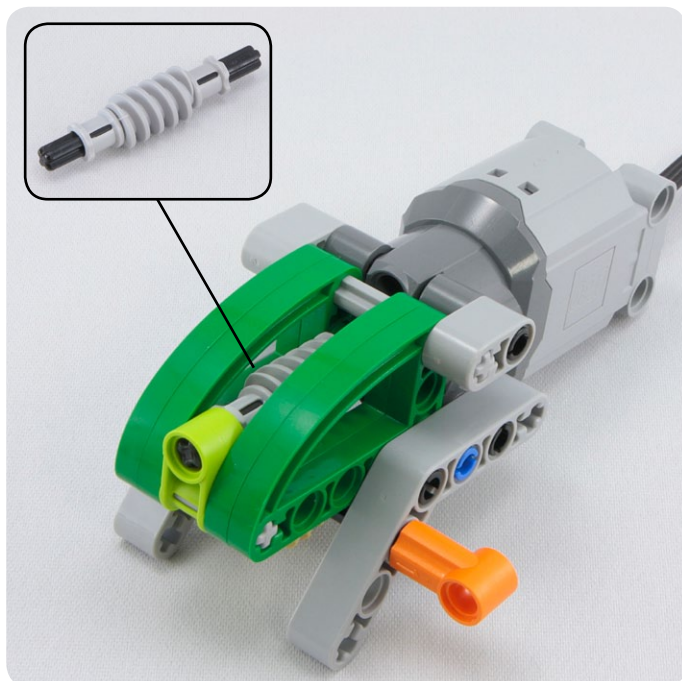
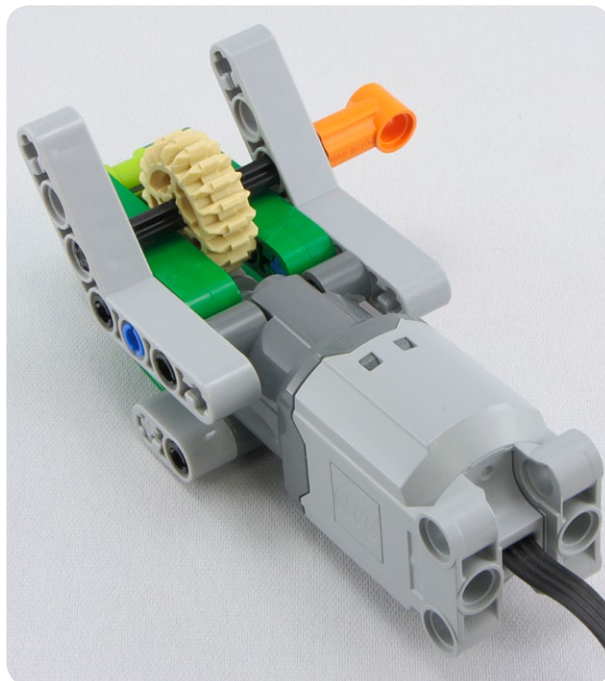


[illegible]

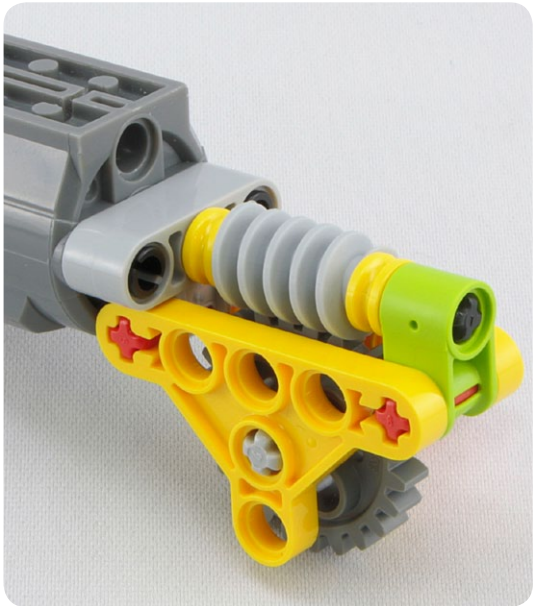
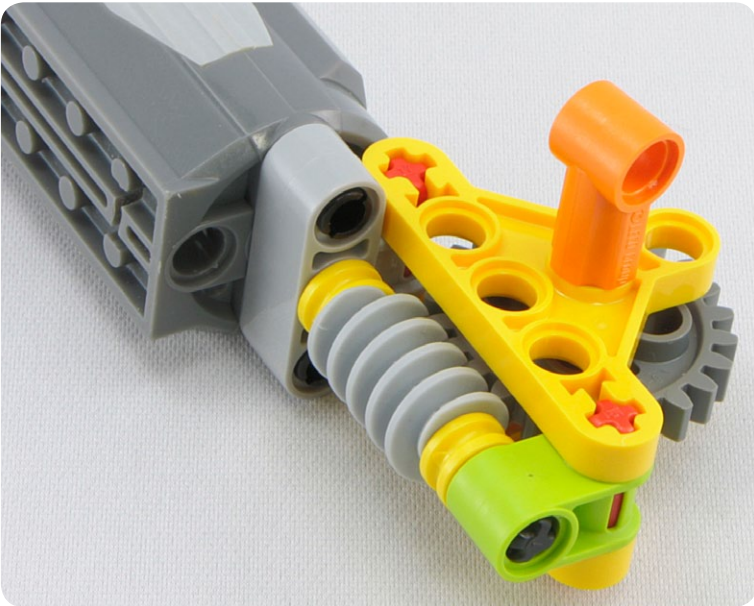
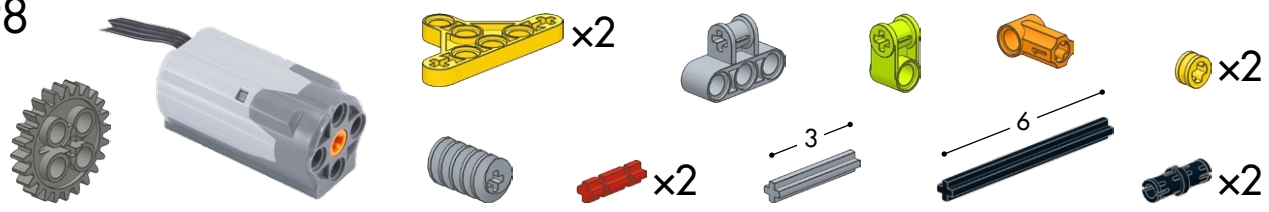
1:20



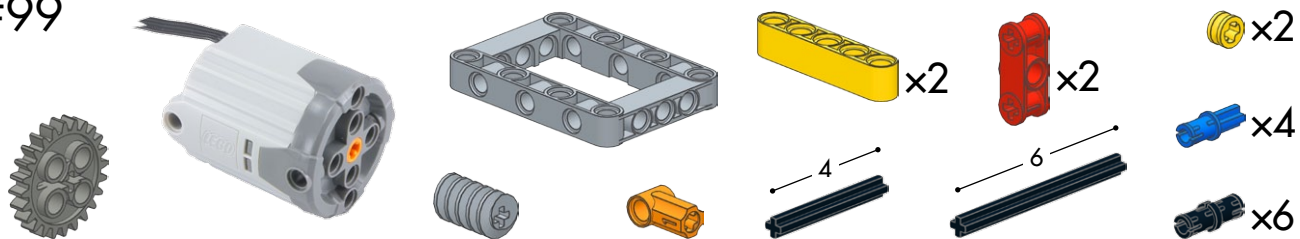
This image shows a LEGO Technic assembly for step 1:20. It features a grey motor connected to a grey axle. A yellow gear is mounted on the axle, which is also connected to a green beam. A white Technic beam is attached to the side of the motor, and a blue pin is visible. The assembly is built using various grey and green Technic components.



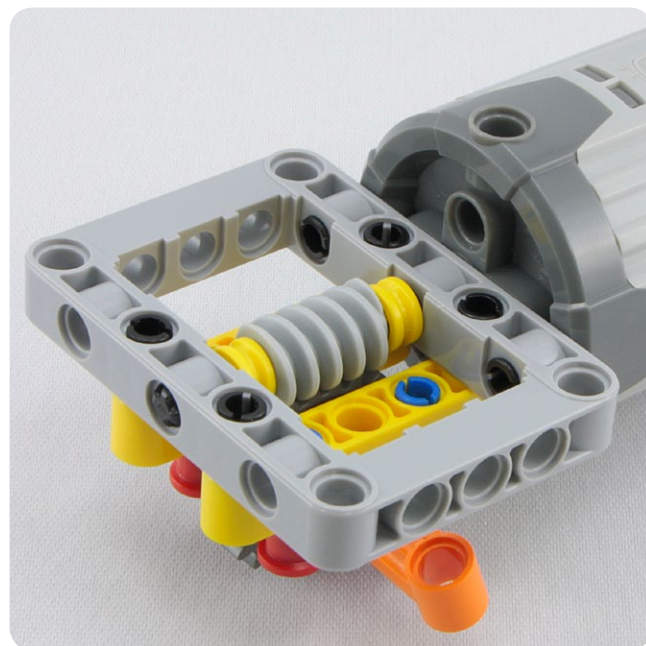
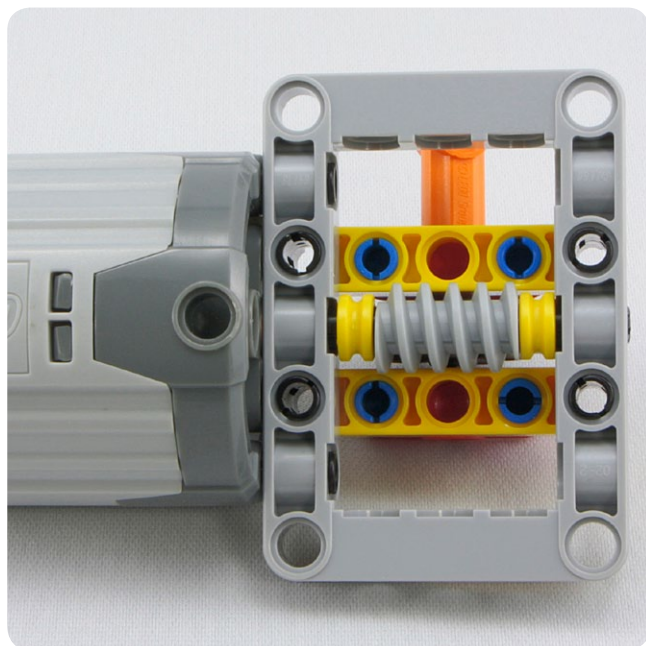
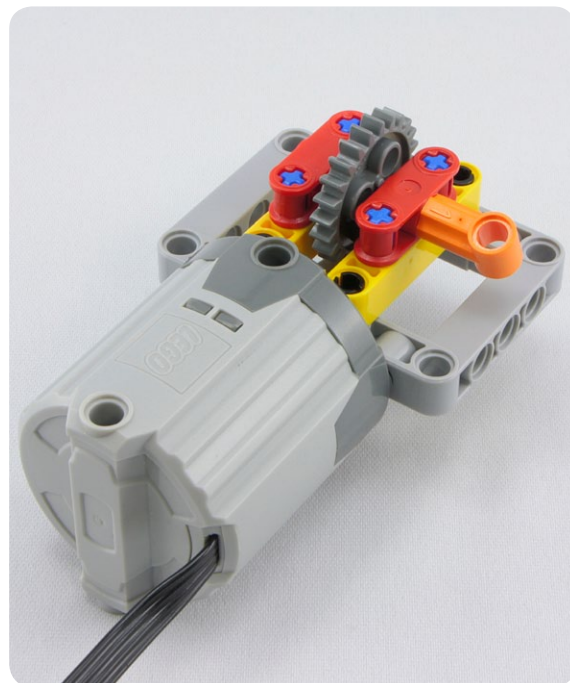
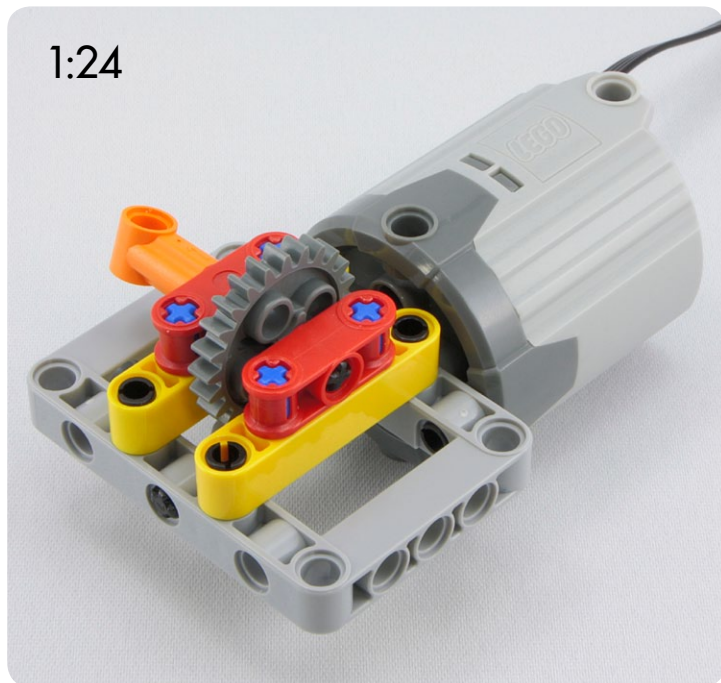
#98



#99



1:24





$\times 3$



x2

 x2

 x2

A diagram of a rectangular prism with a length of 3 units and a width of 2 units. The length is indicated by a line segment with dots at both ends, labeled with the number 3. The width is indicated by a line segment with dots at both ends, labeled with the number 2. The prism is shown in a 3D perspective.

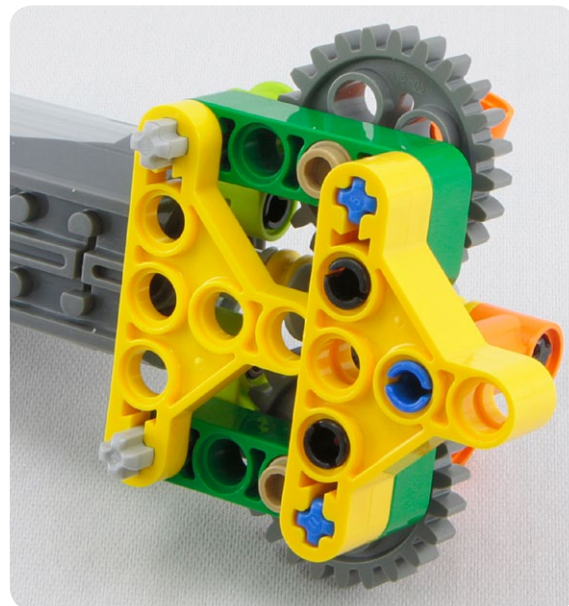
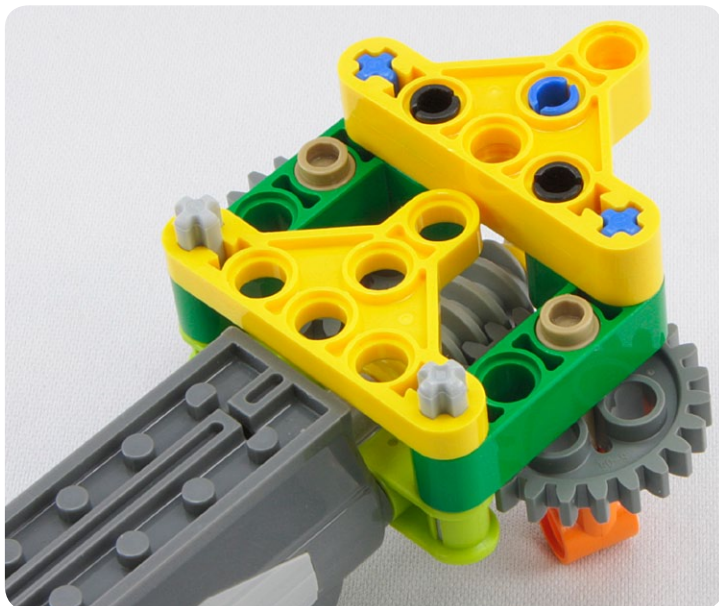
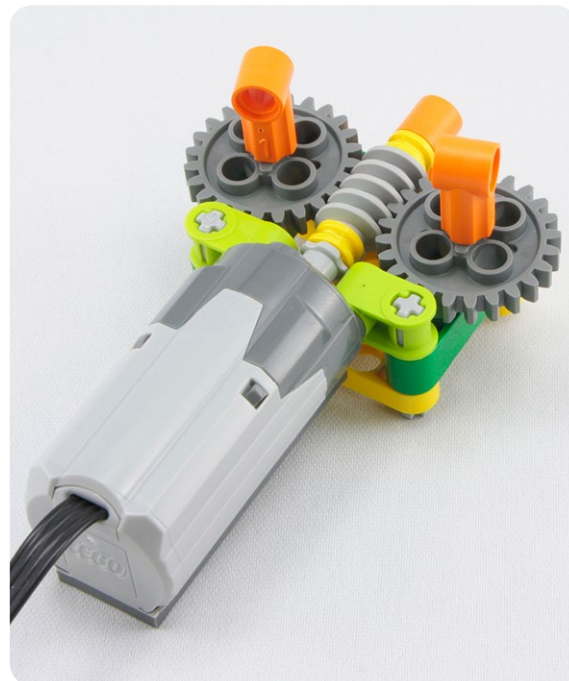
 x3

A diagram showing a section of a pipe with a length dimension line above it labeled '6'.

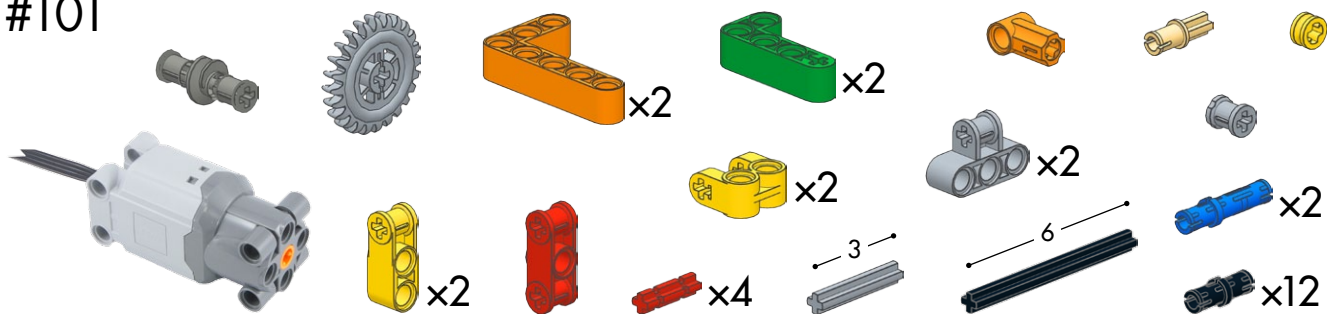
 x3

4x Blue Cable Ties

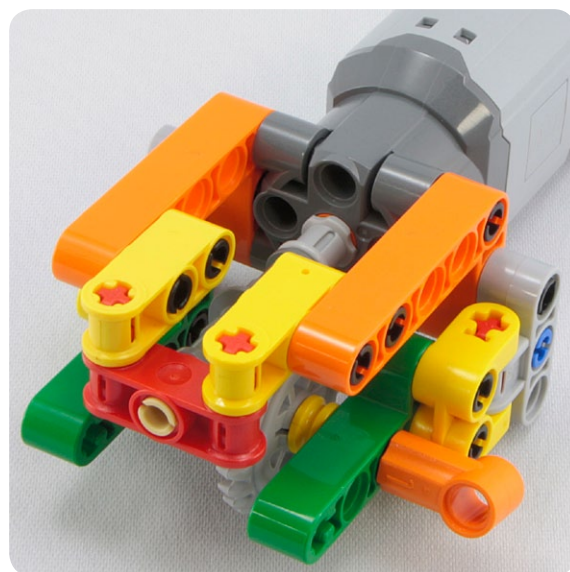
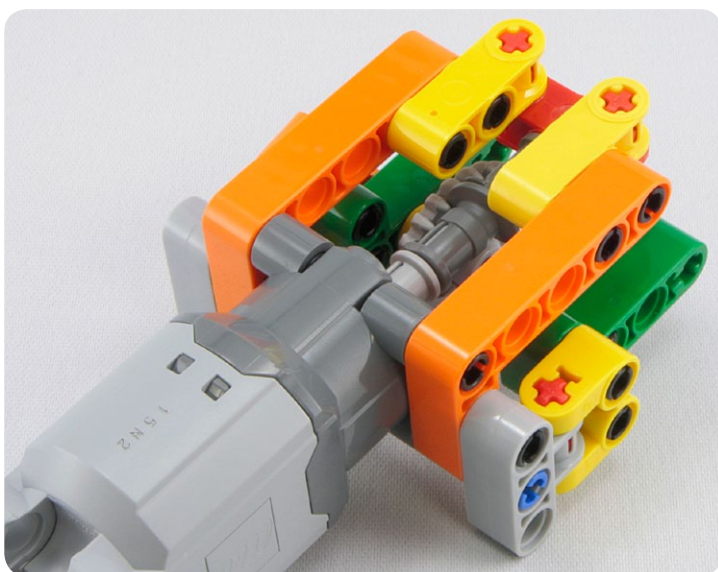
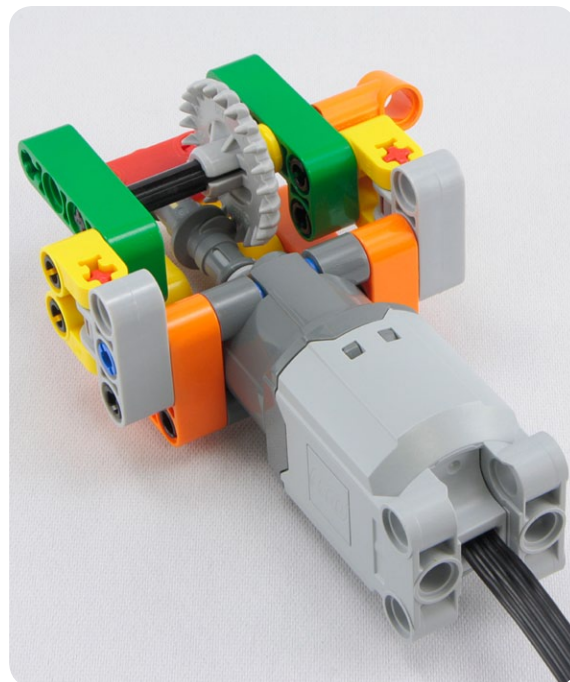
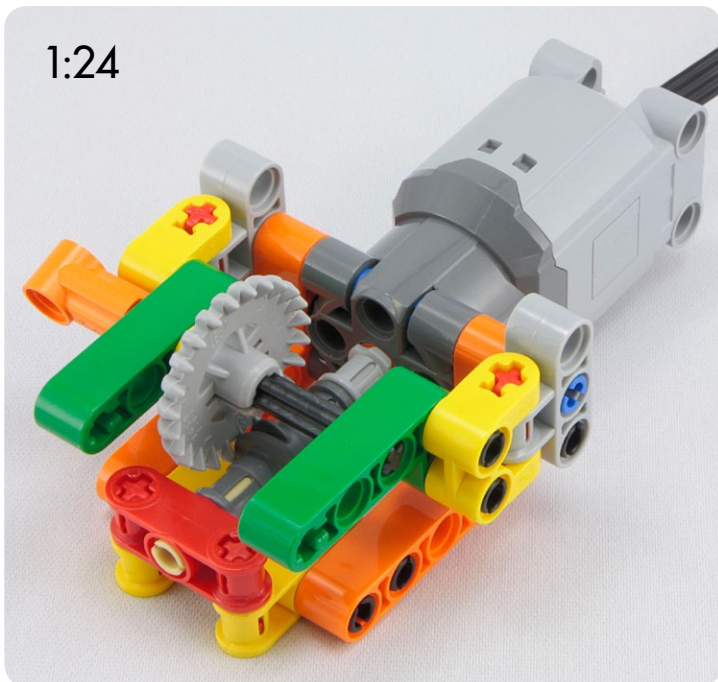
1:24

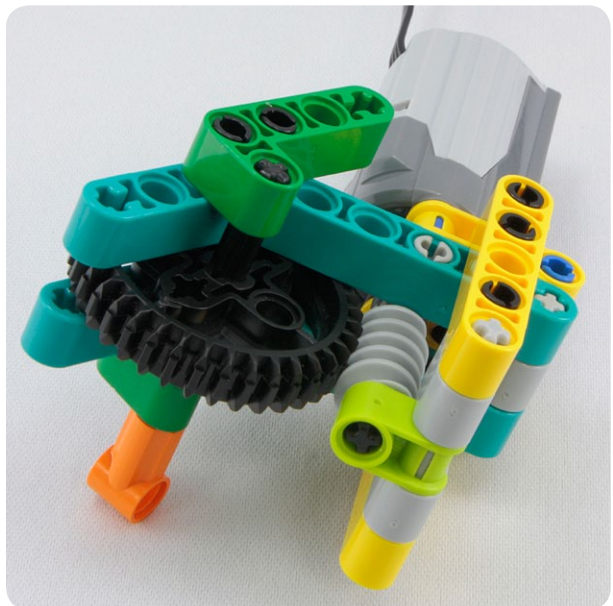
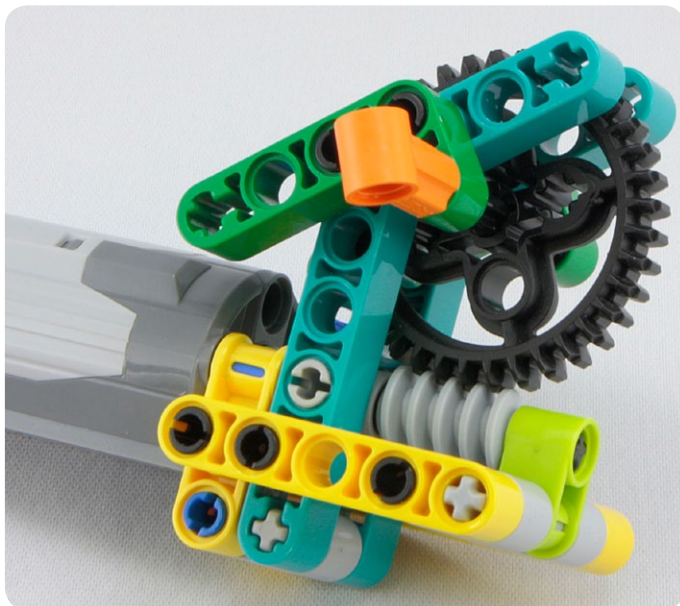
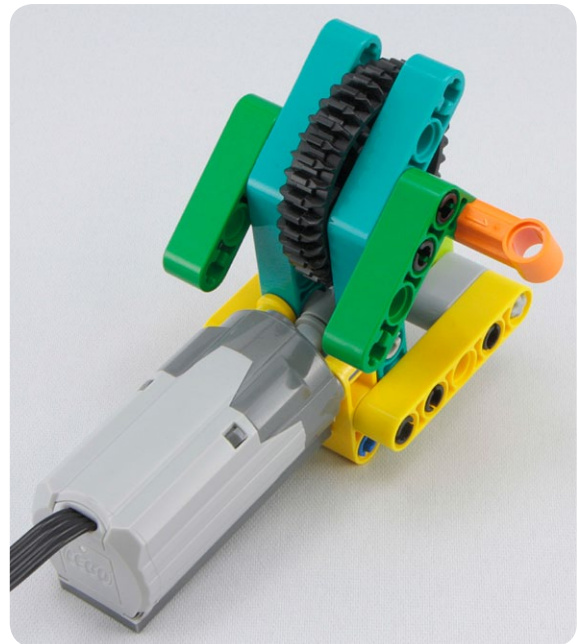


#101

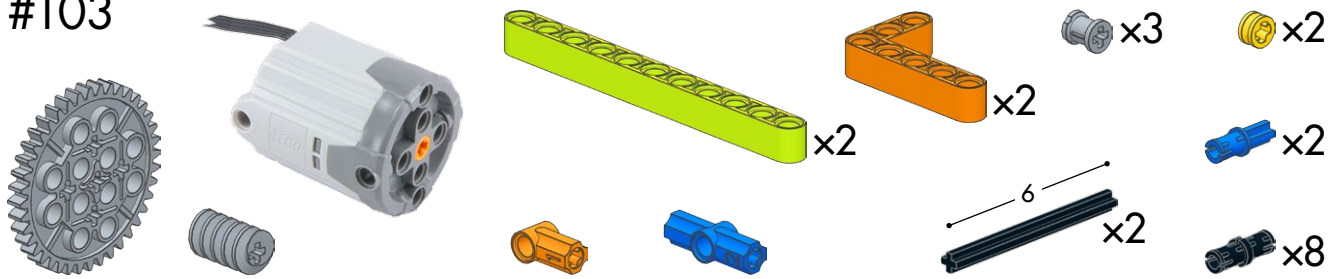


1:24

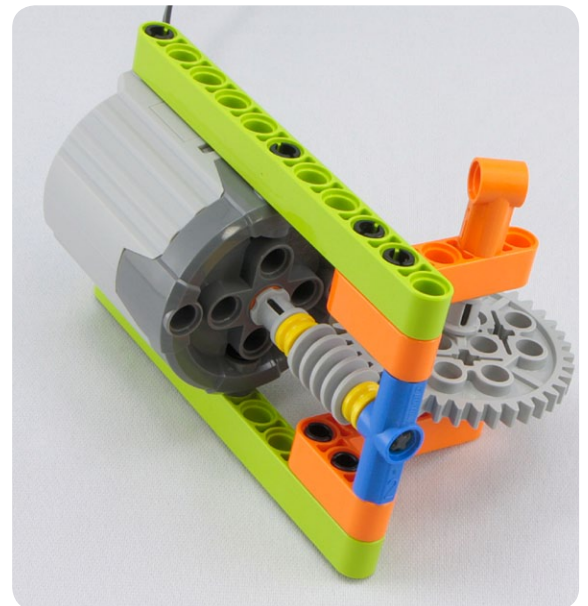
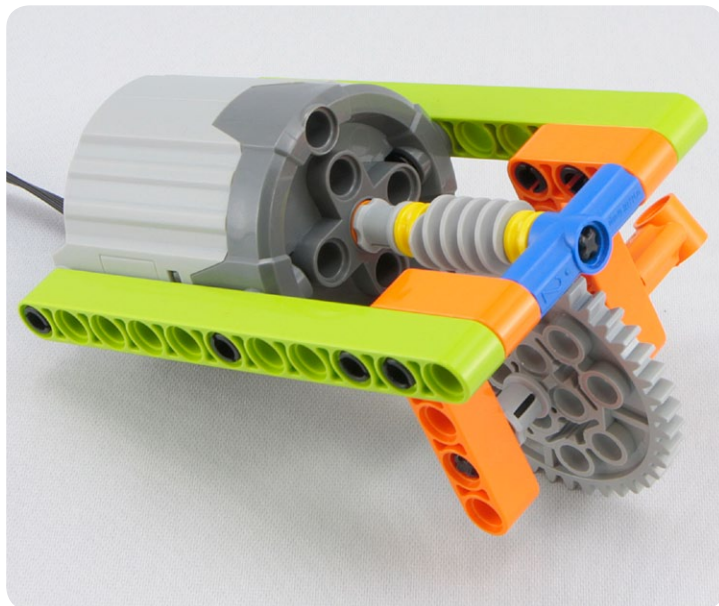
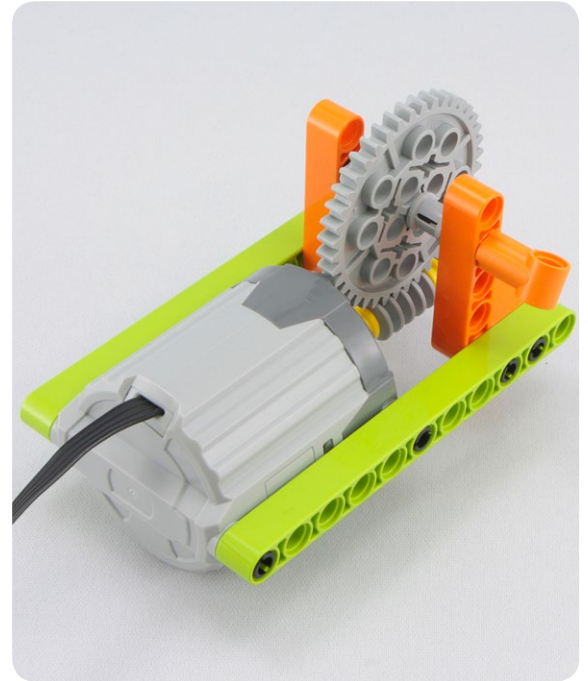
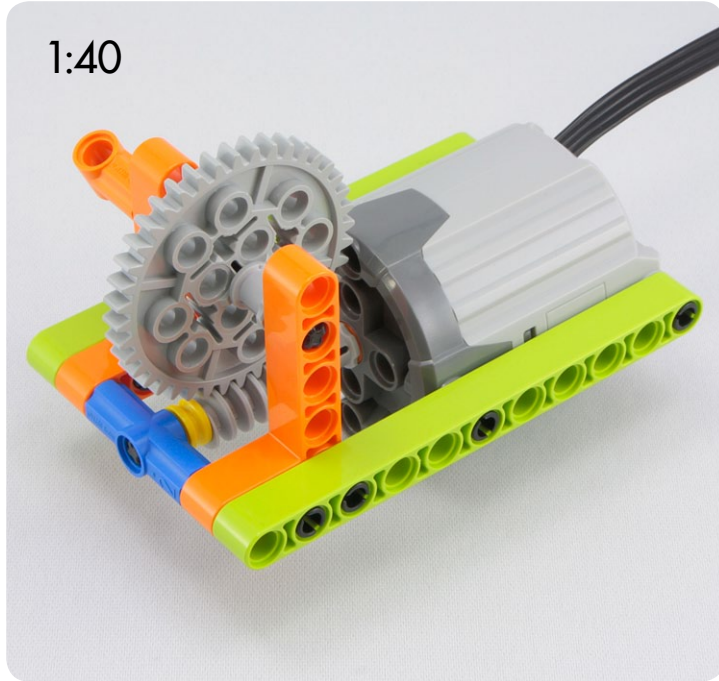


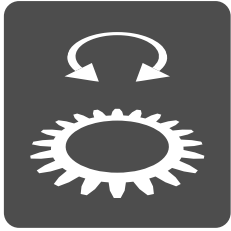
[illegible]

#103



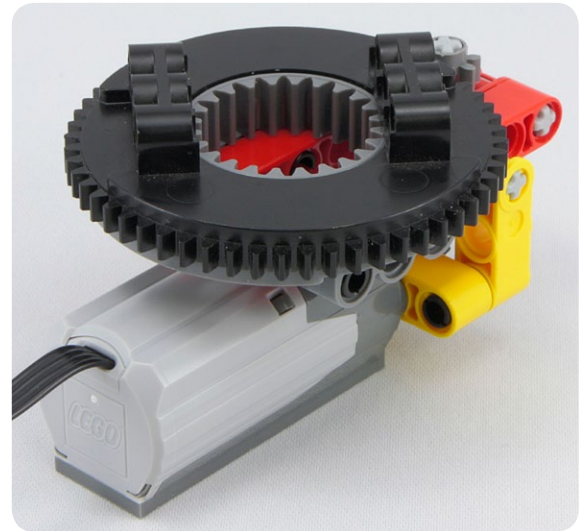
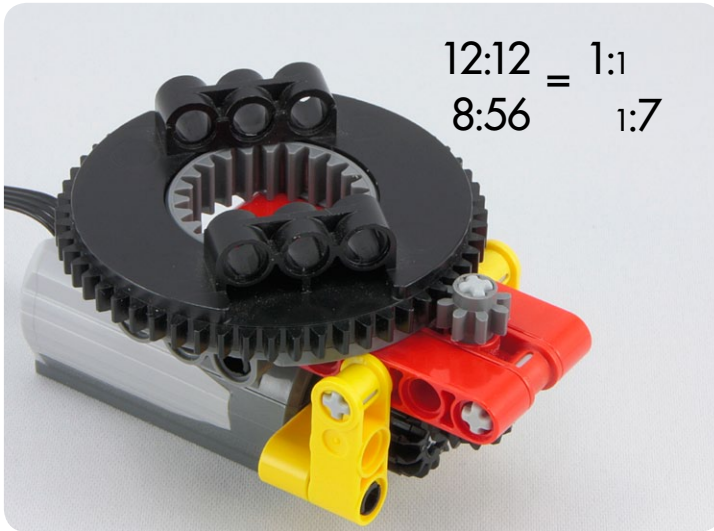
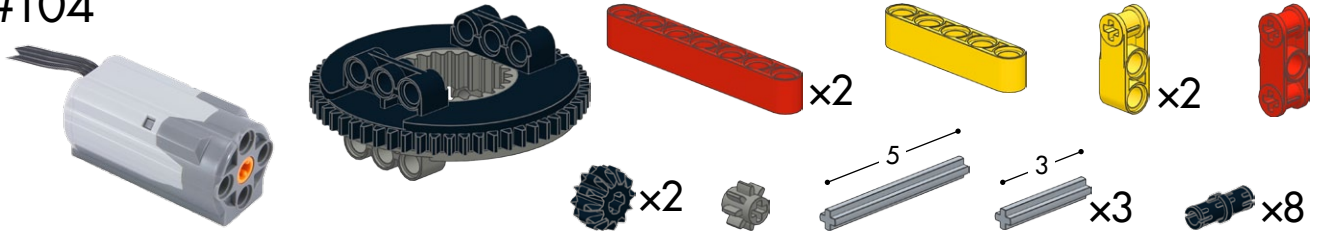
1:40



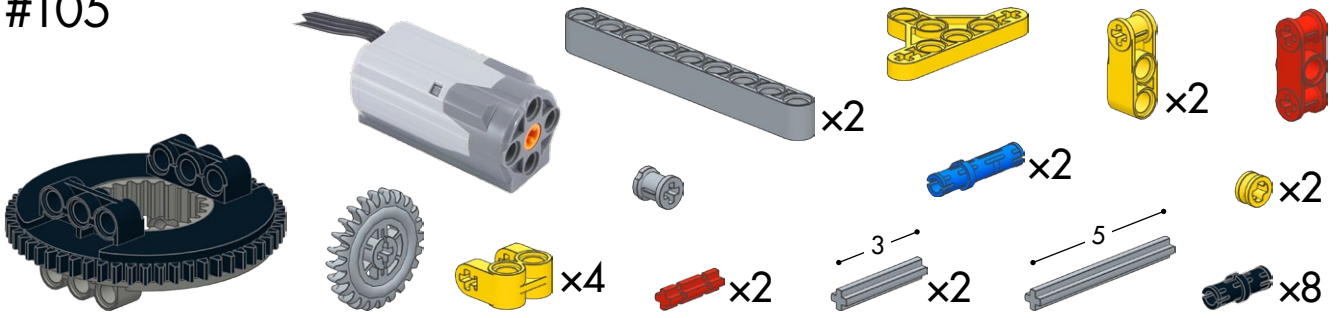
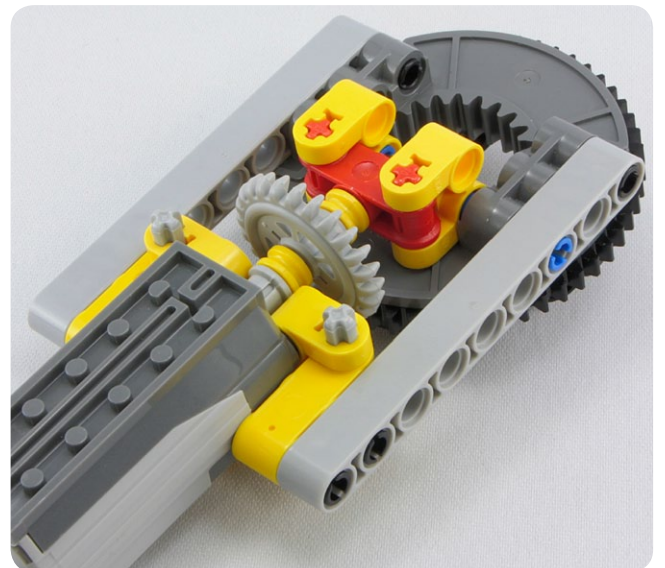
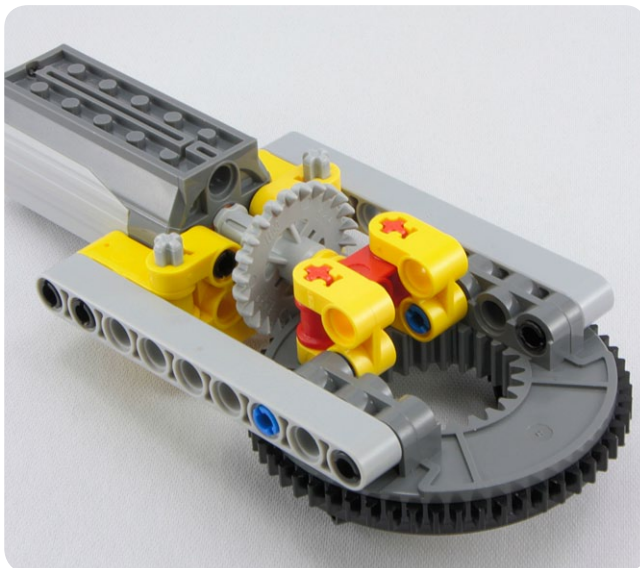
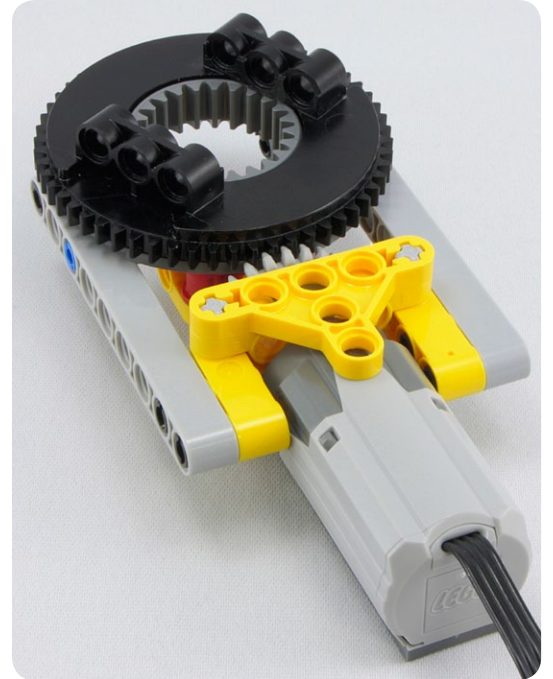
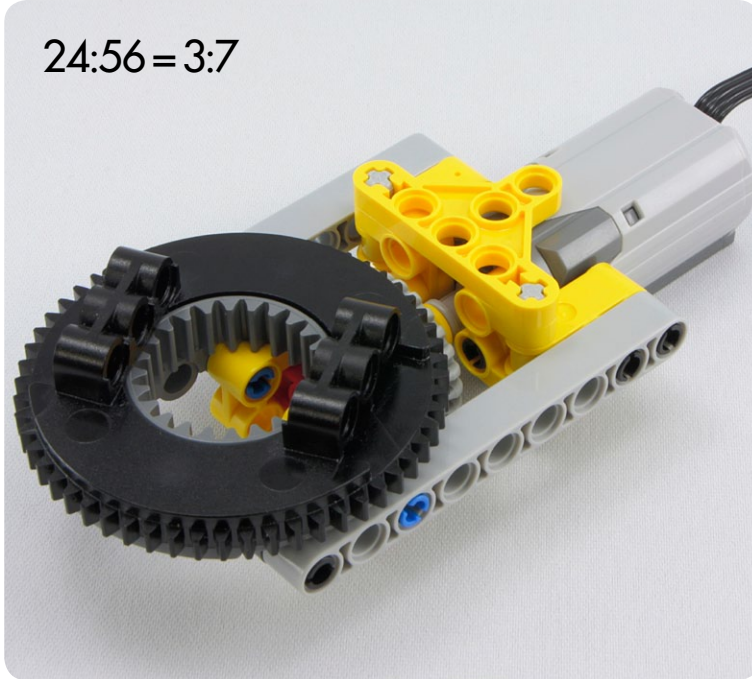


Using turntables

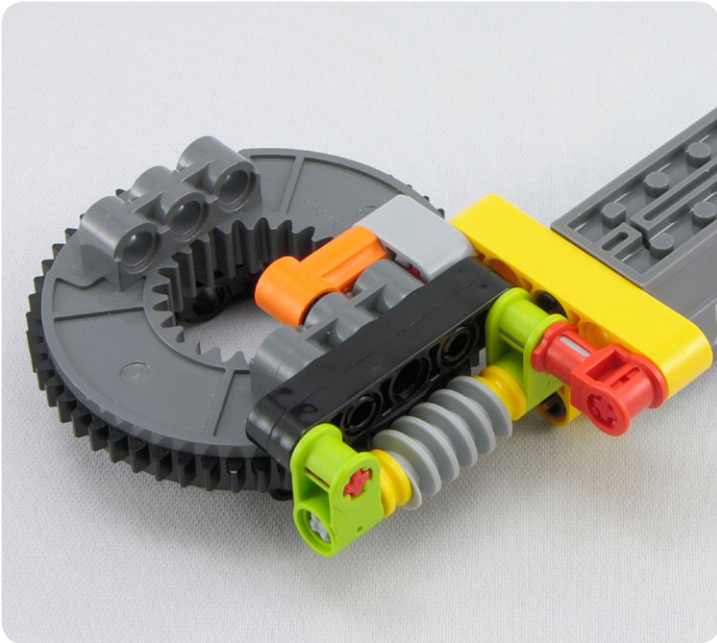
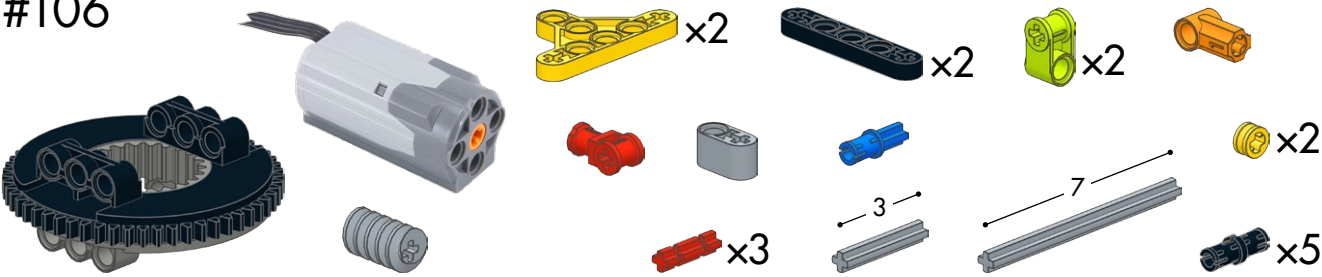
#104



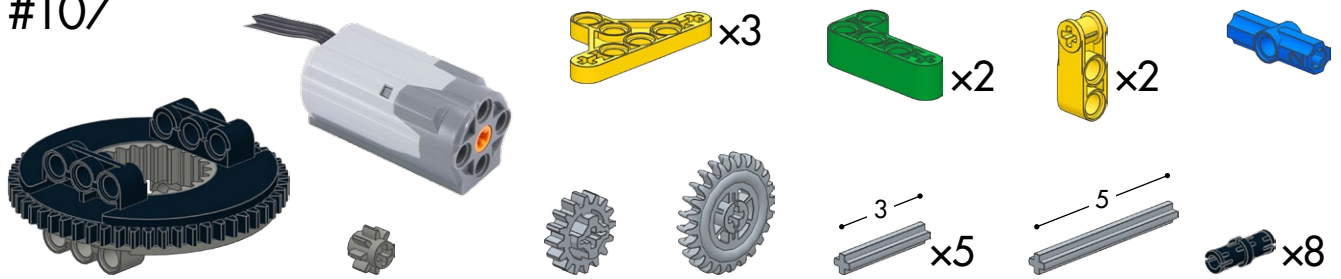
#105


$$24:56 = 3:7$$


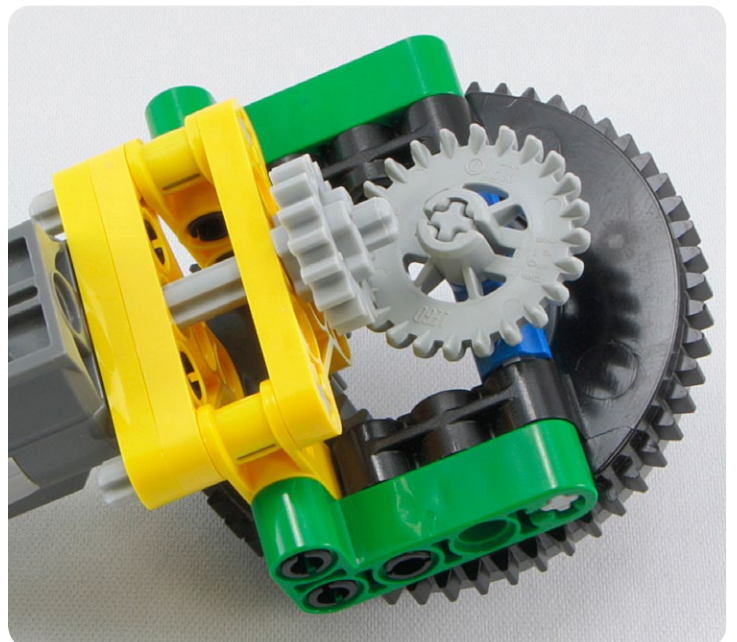
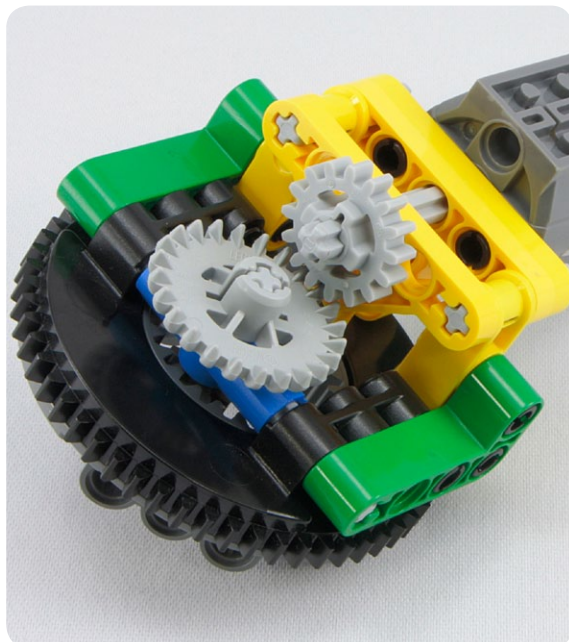
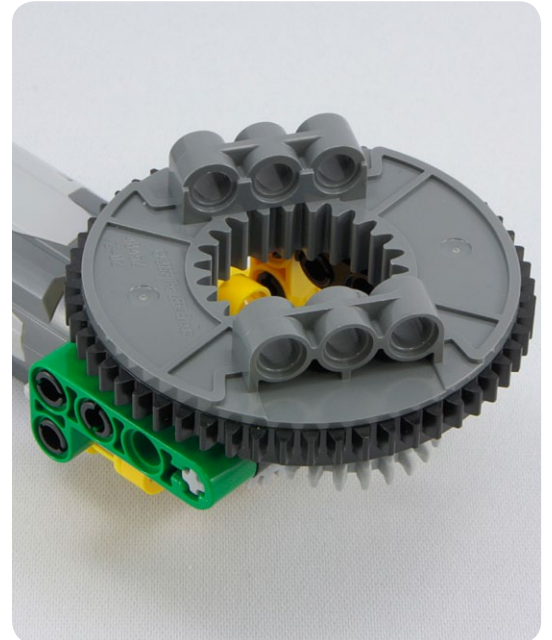
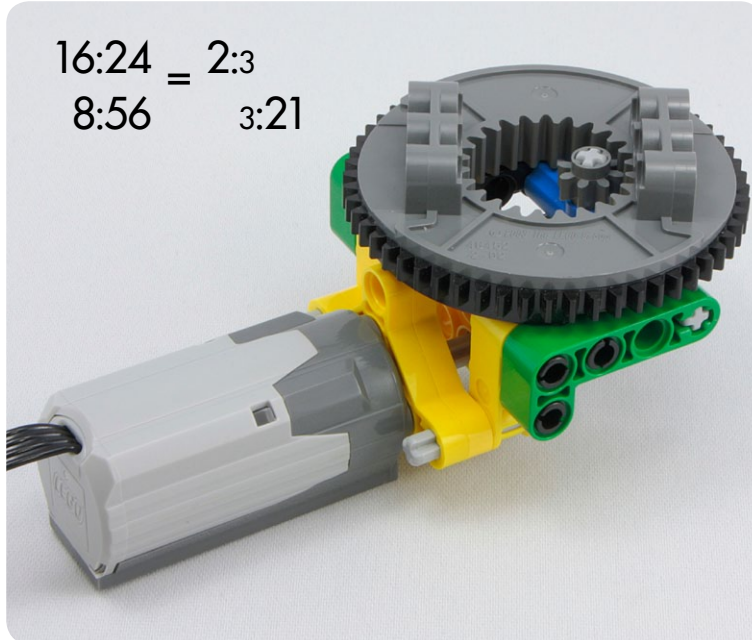
#106



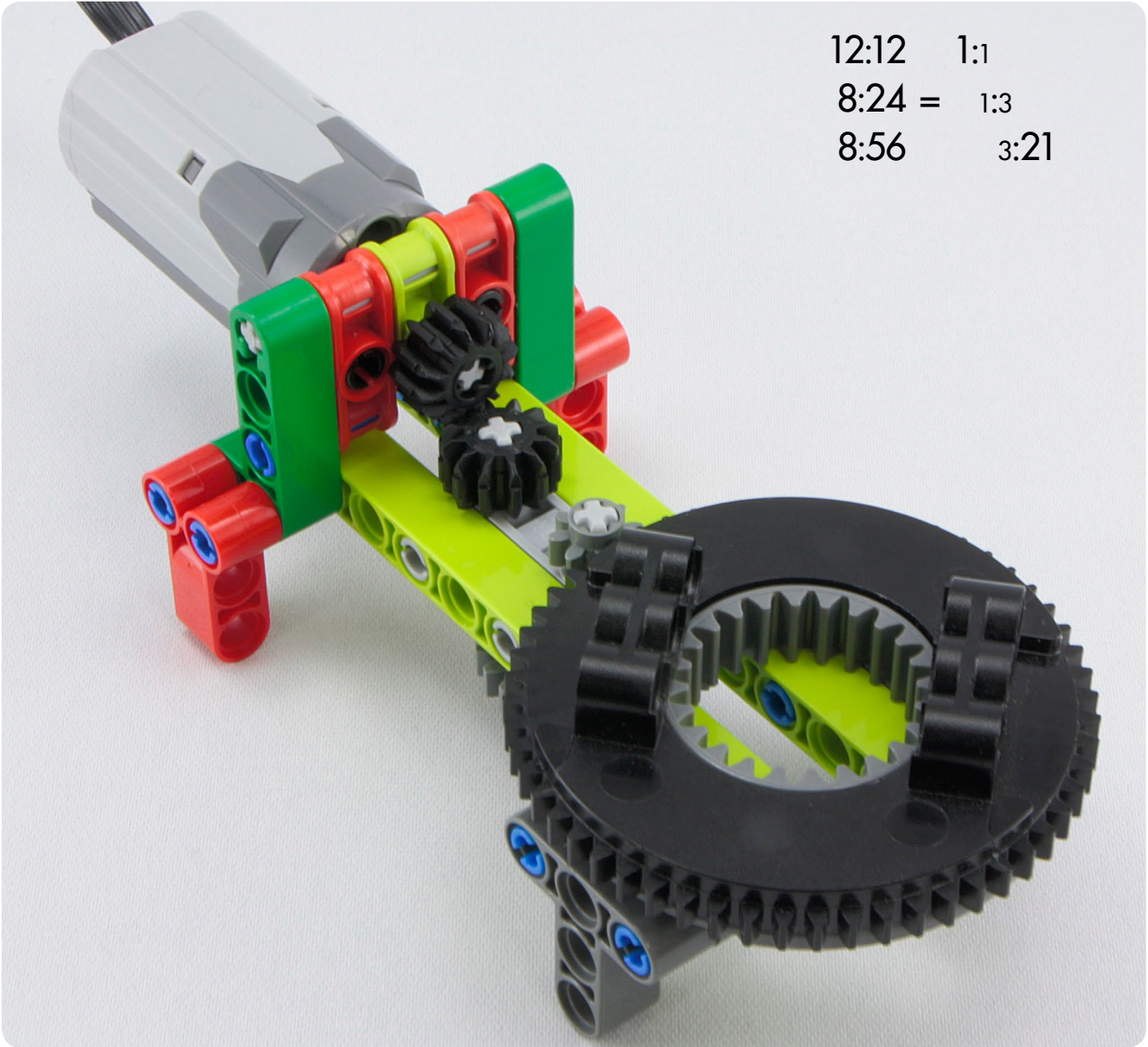
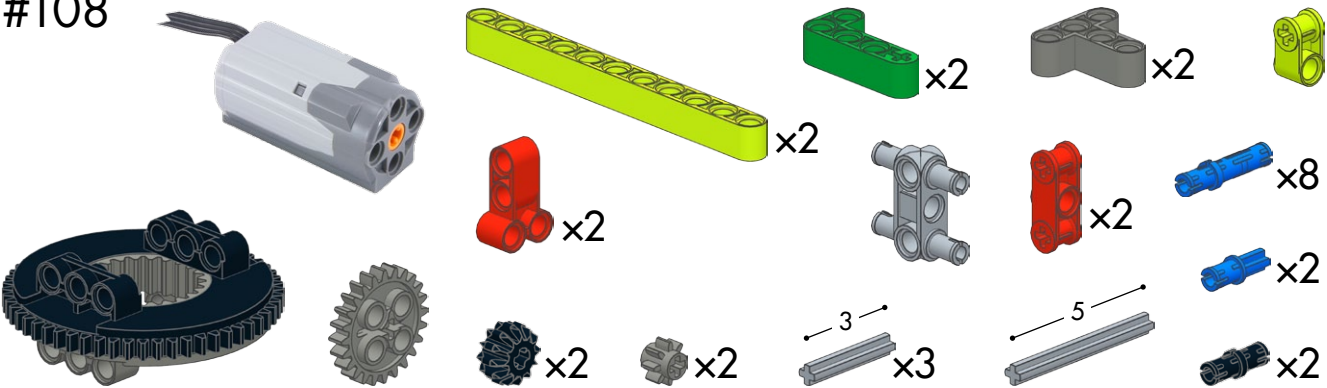
#107

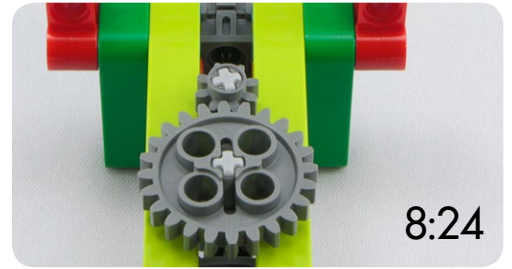
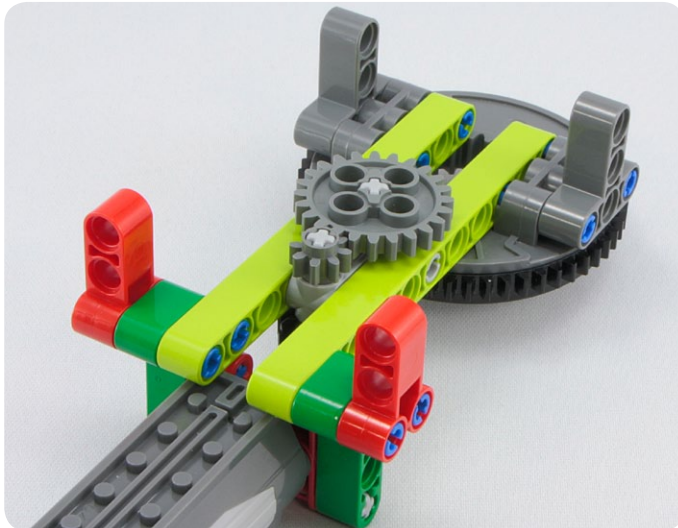
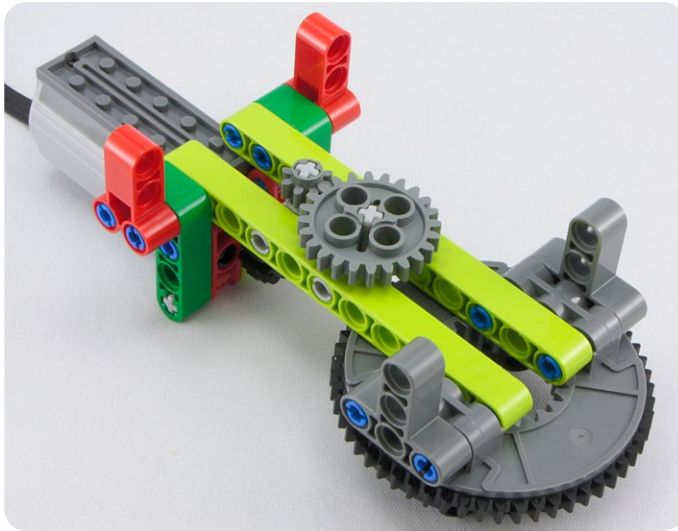
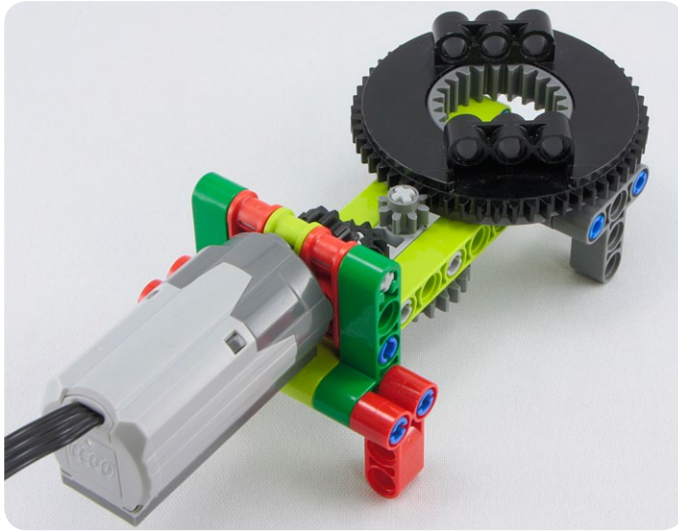


16:24 = 2:3
8:56 = 3:21

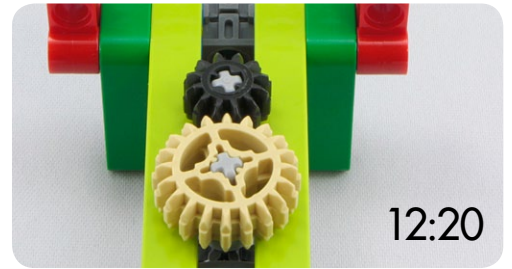


#108

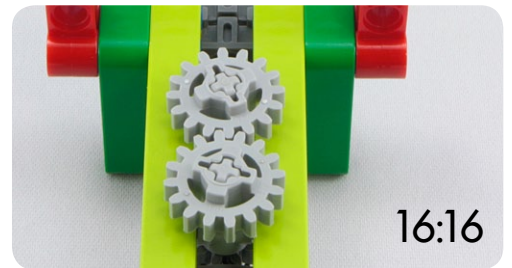




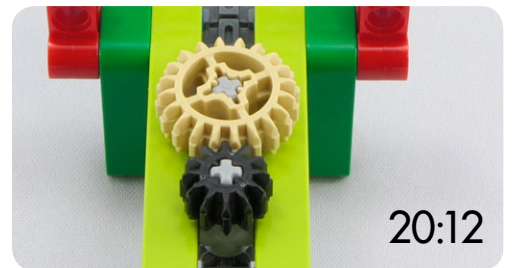
8:24



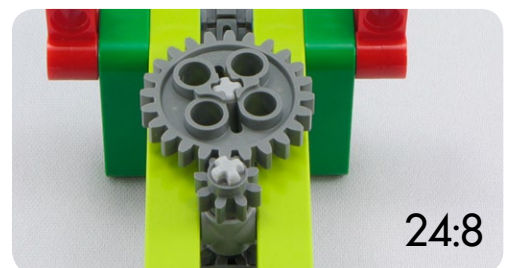
12:20



16:16

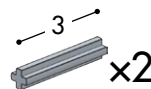
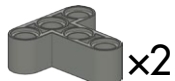
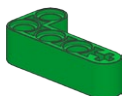


20:12

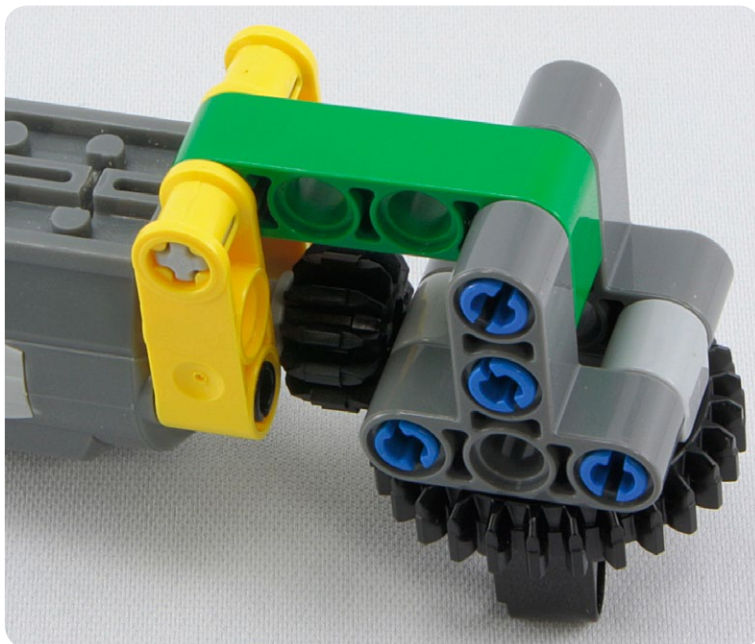
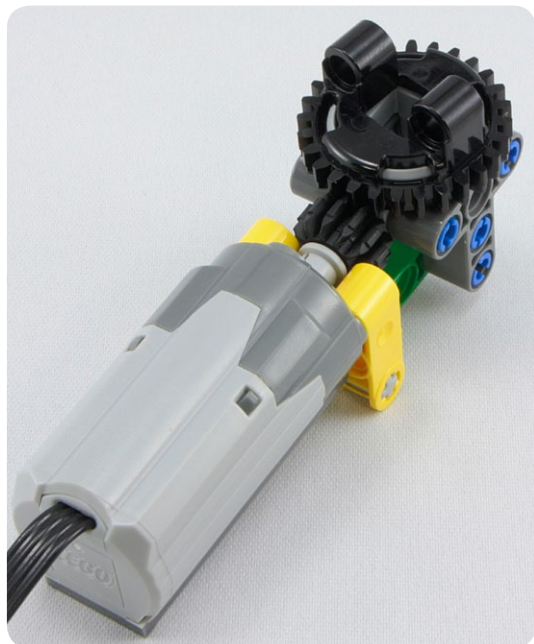
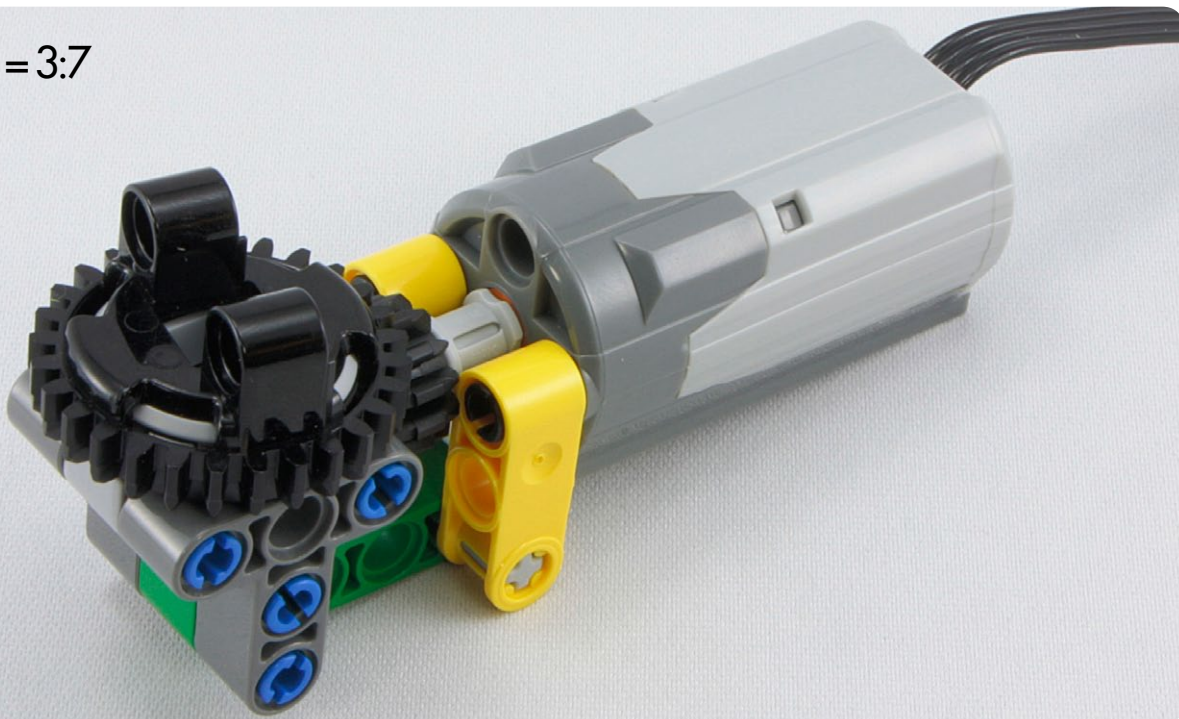


24:8

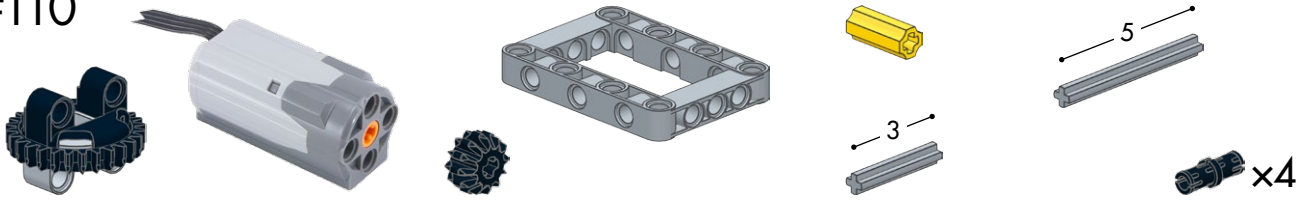
#109



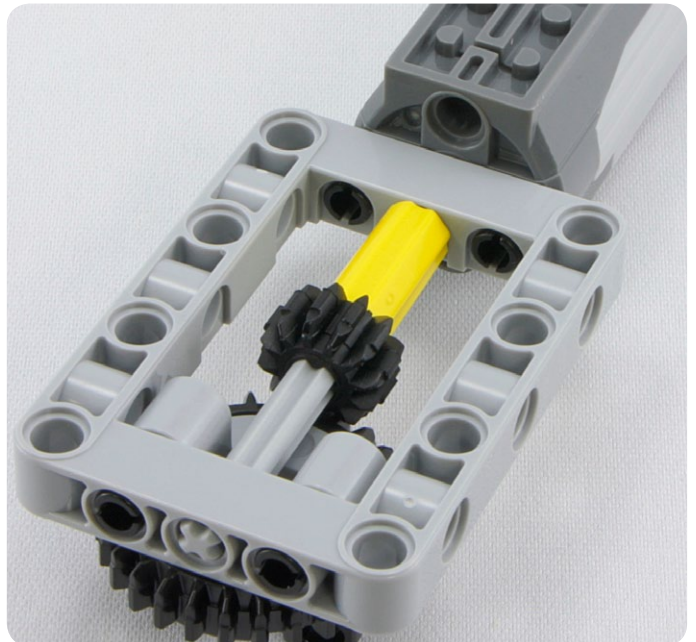
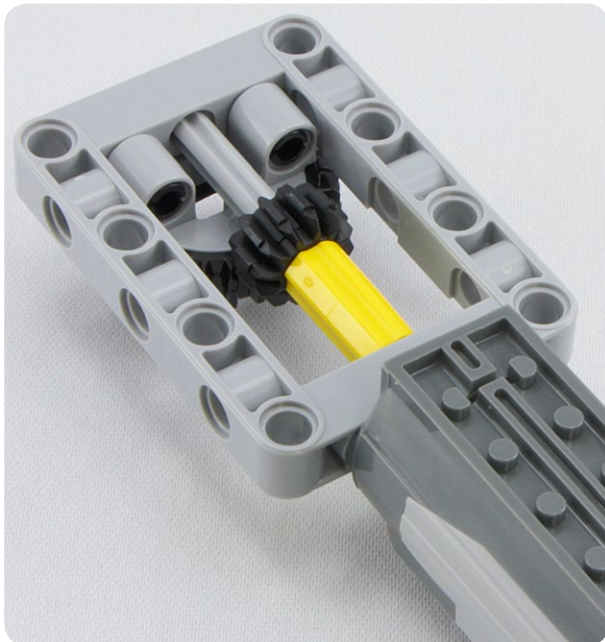
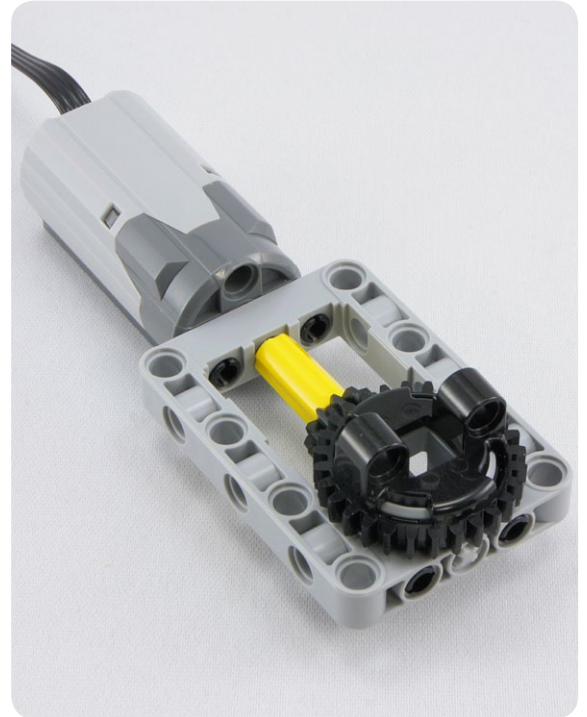
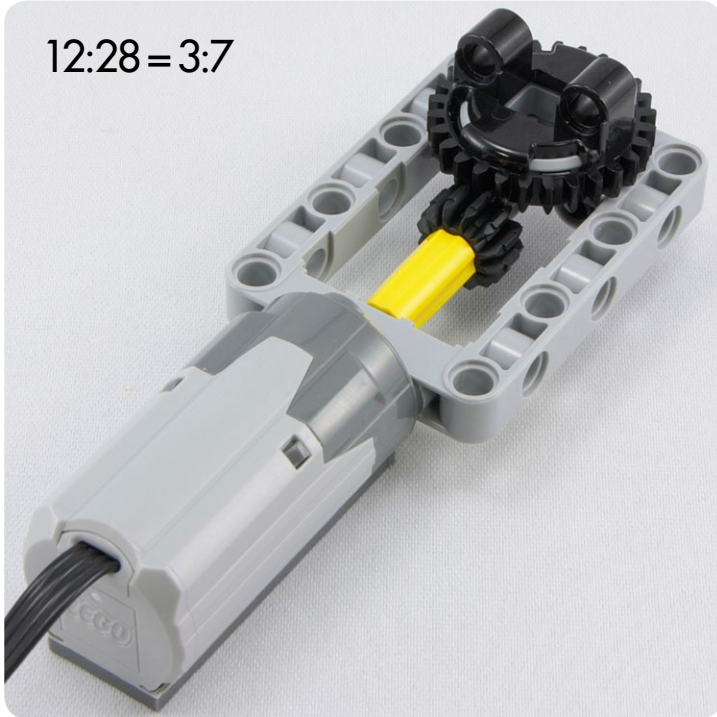
12:28 = 3:7



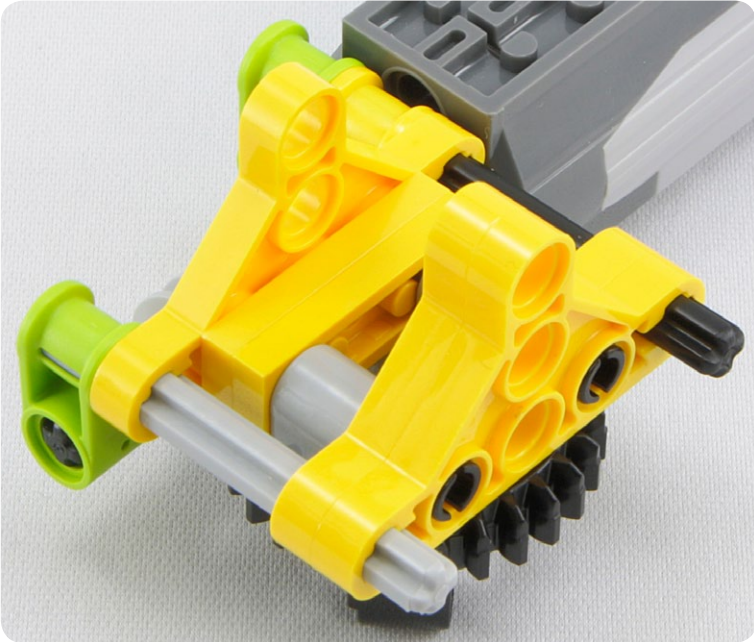
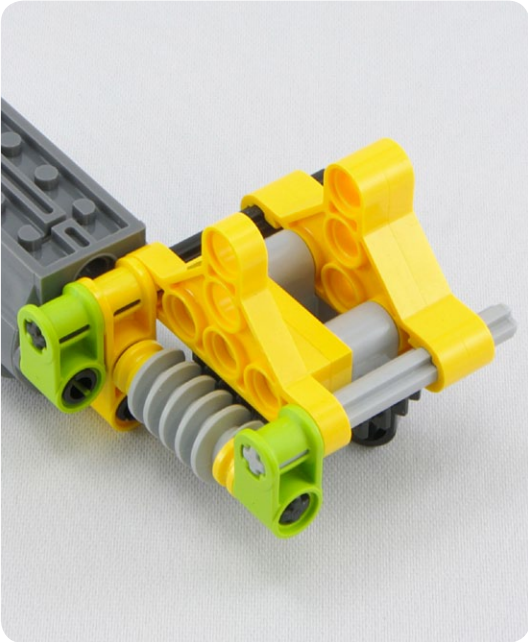
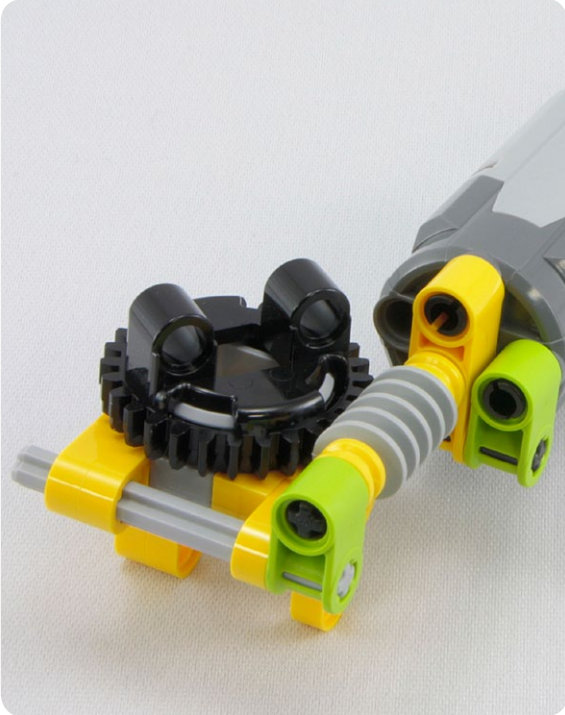
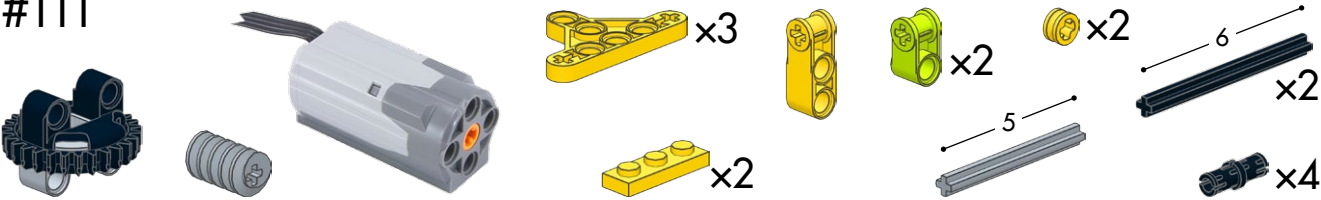
#110



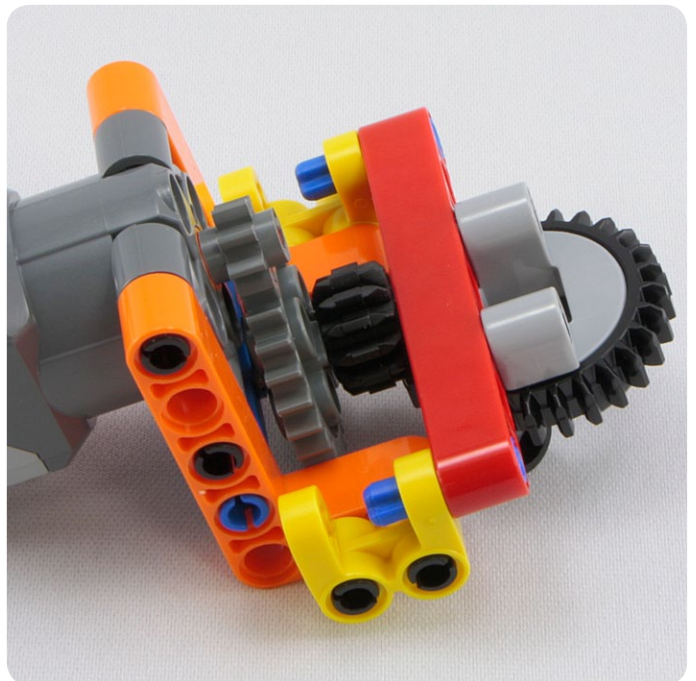
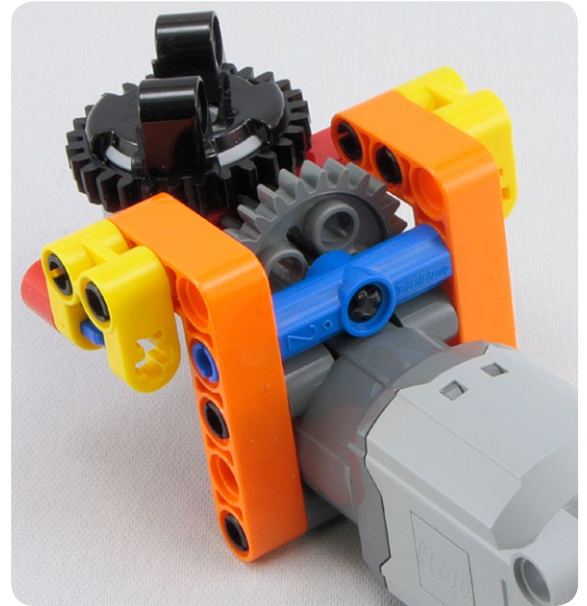
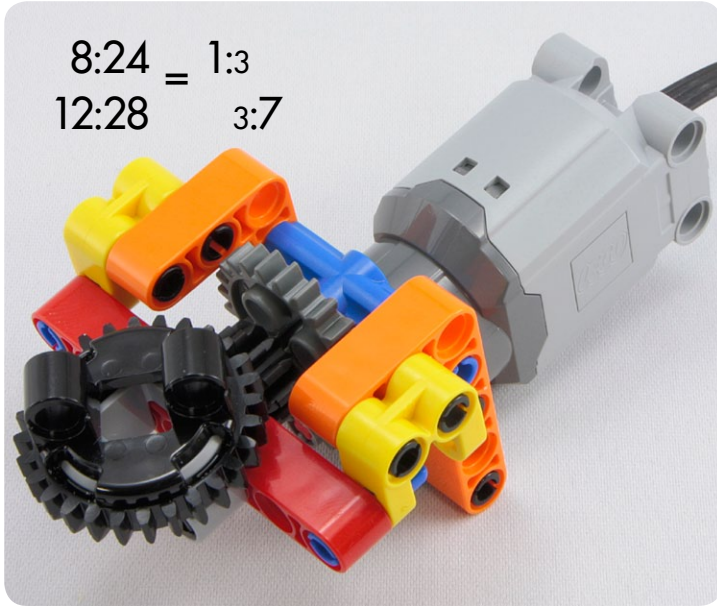
12:28 = 3:7

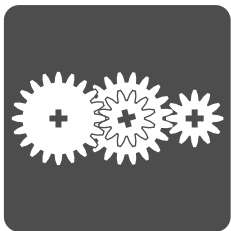


#111



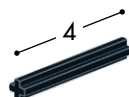
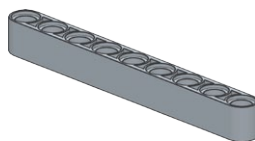
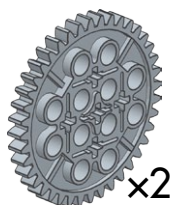
#112


$$\frac{8:24}{12:28} = \frac{1:3}{3:7}$$


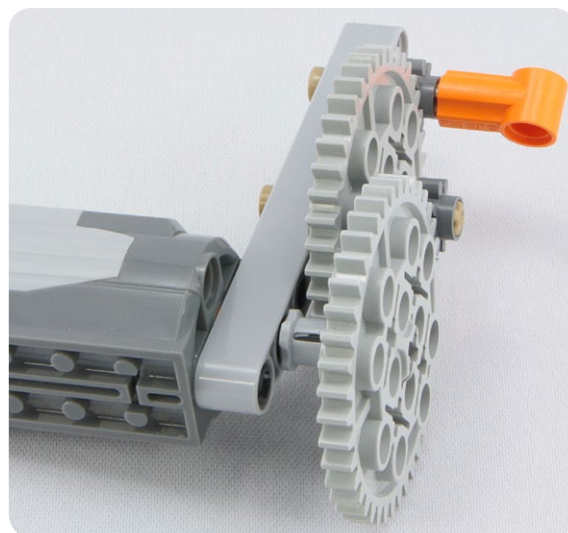
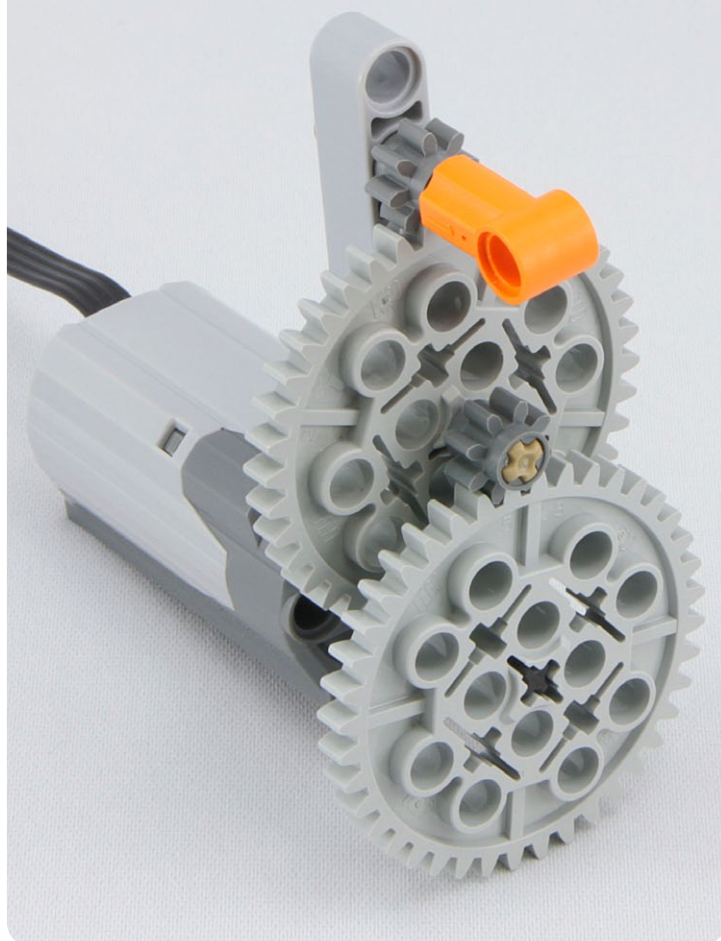


Gear systems

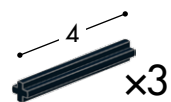
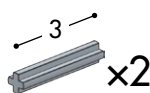
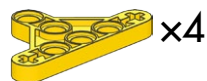
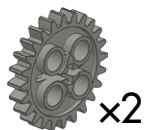
#113



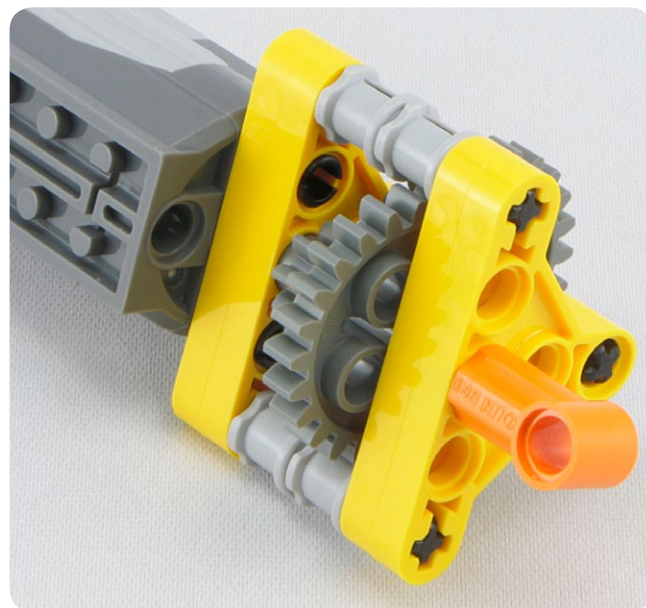
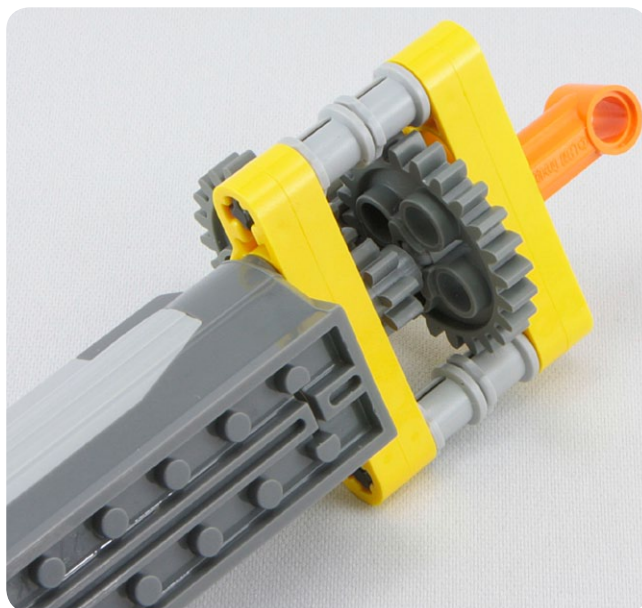
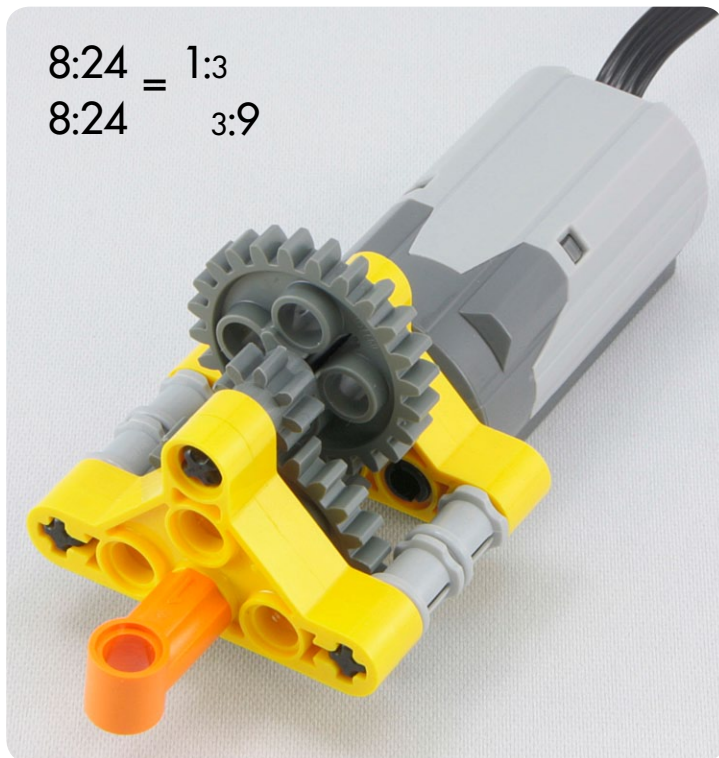
$$\begin{array}{l} 40:8 = 25:5 \\ 40:8 \quad 5:1 \end{array}$$



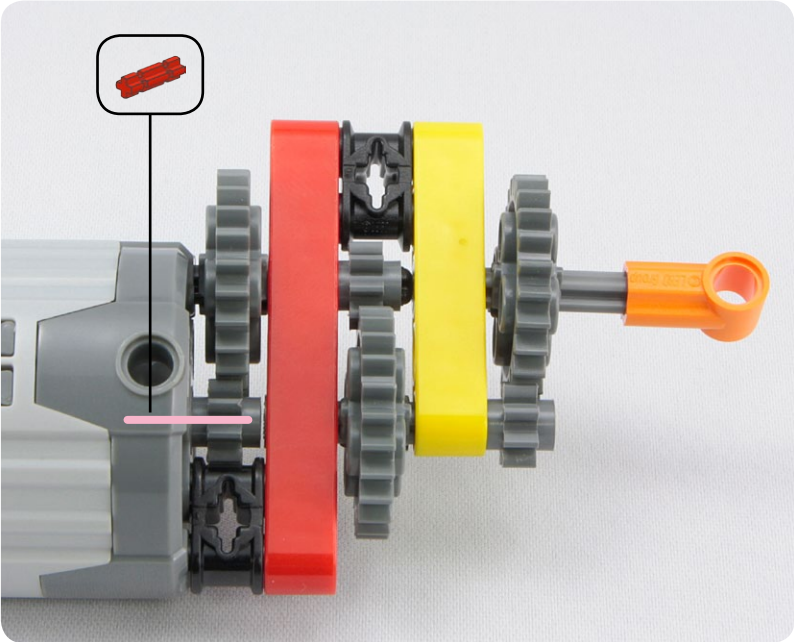
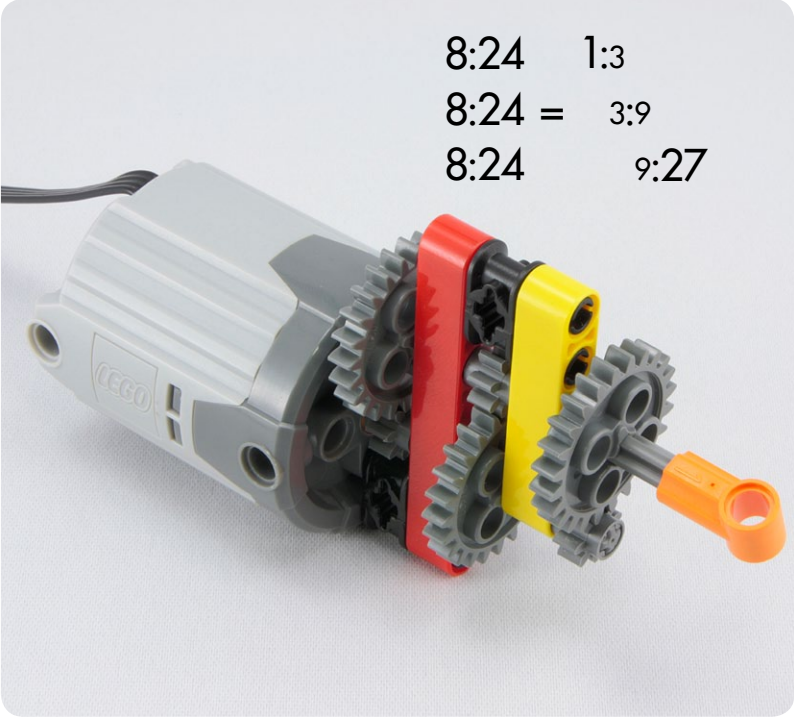
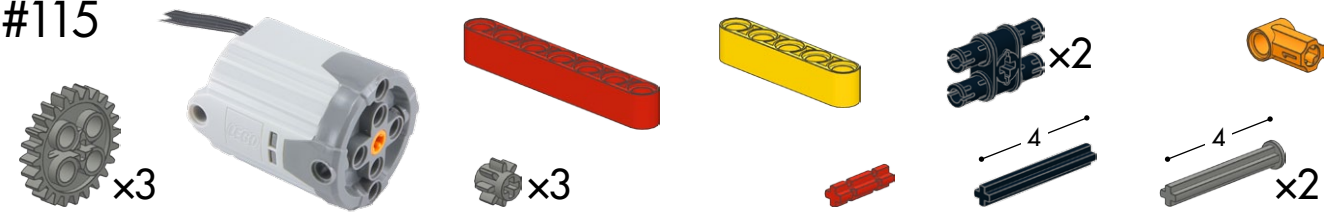
#114



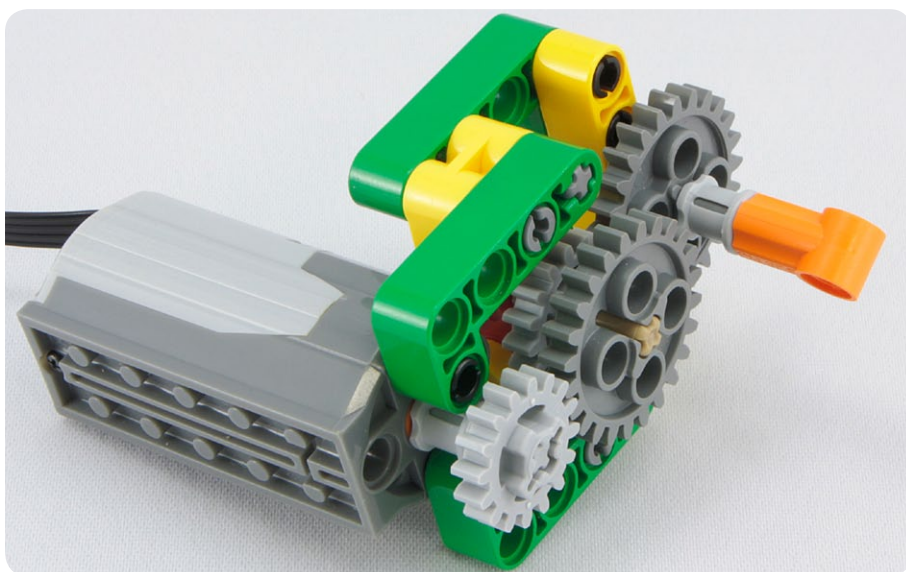
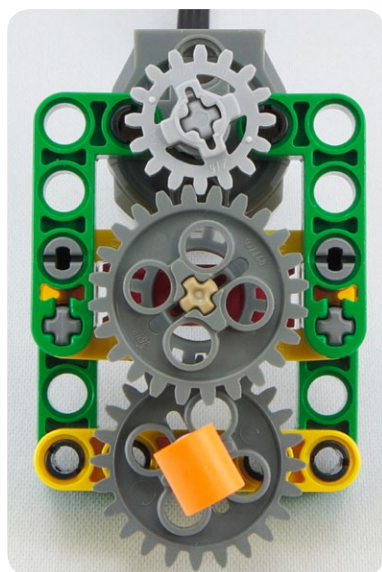
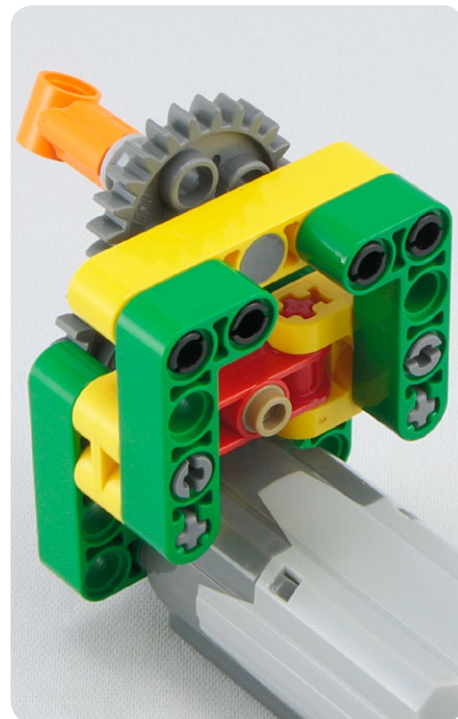
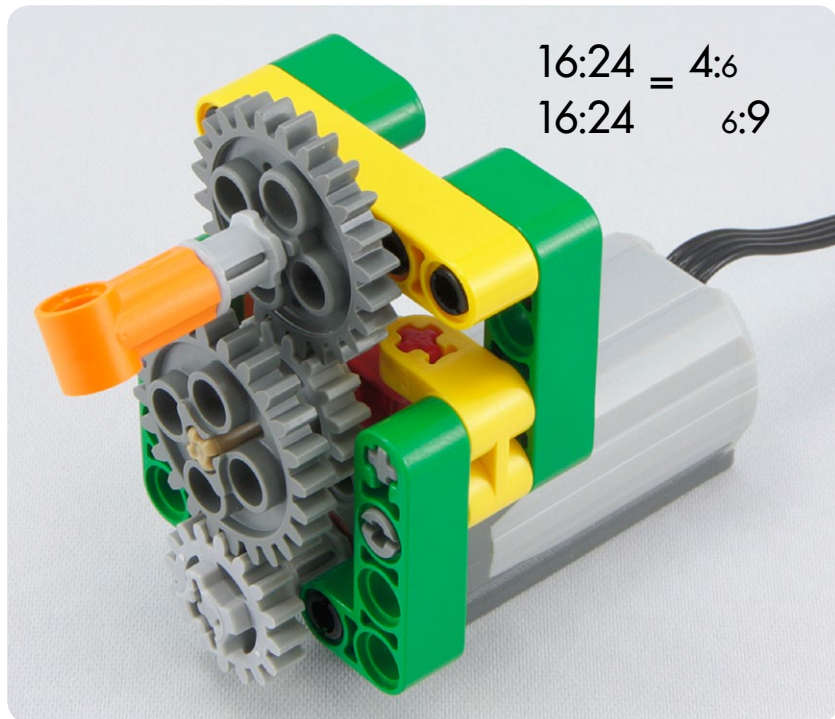
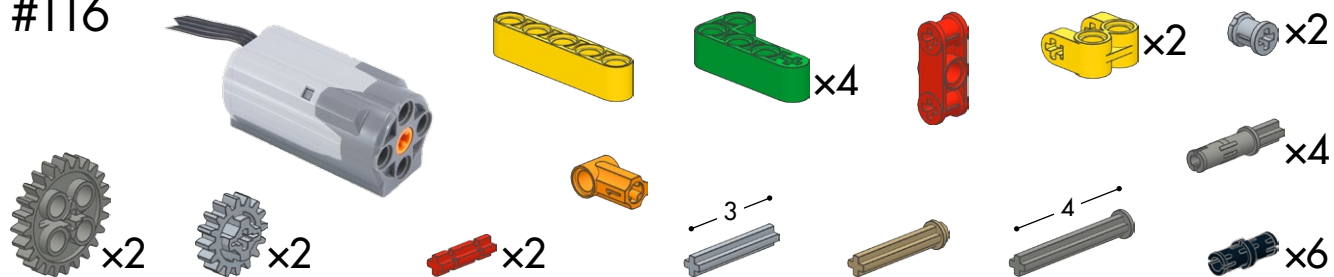
$8:24 = 1:3$
 $8:24 = 3:9$



#115

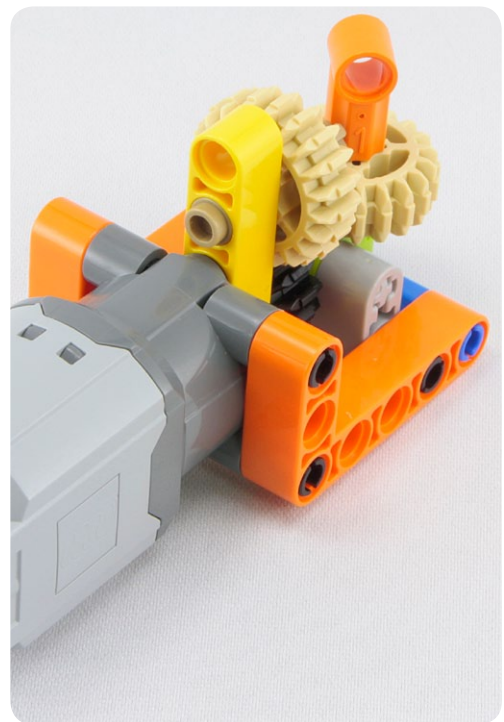
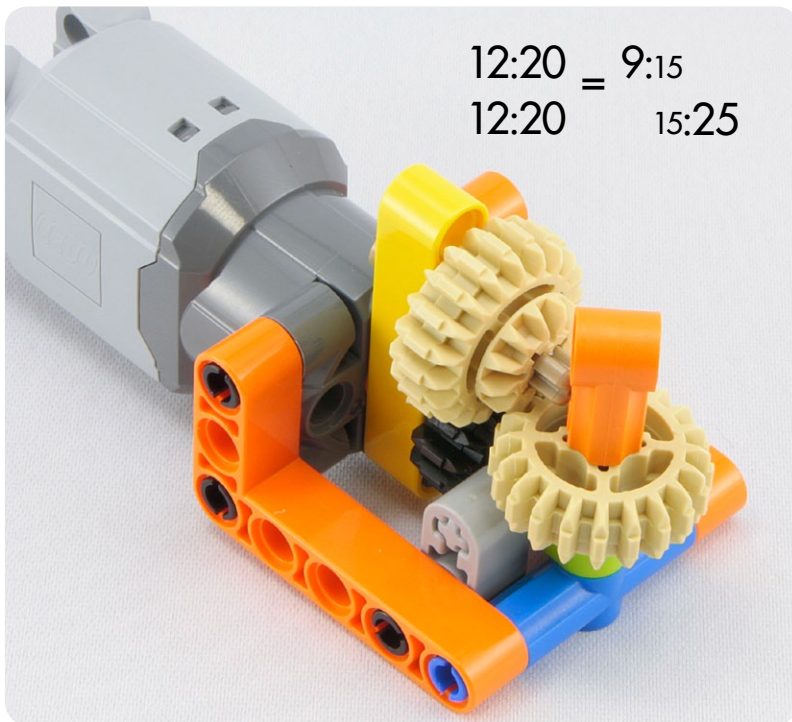


#116

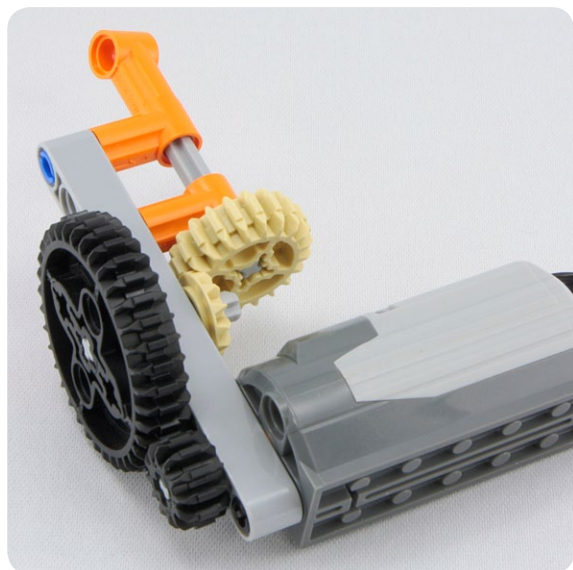
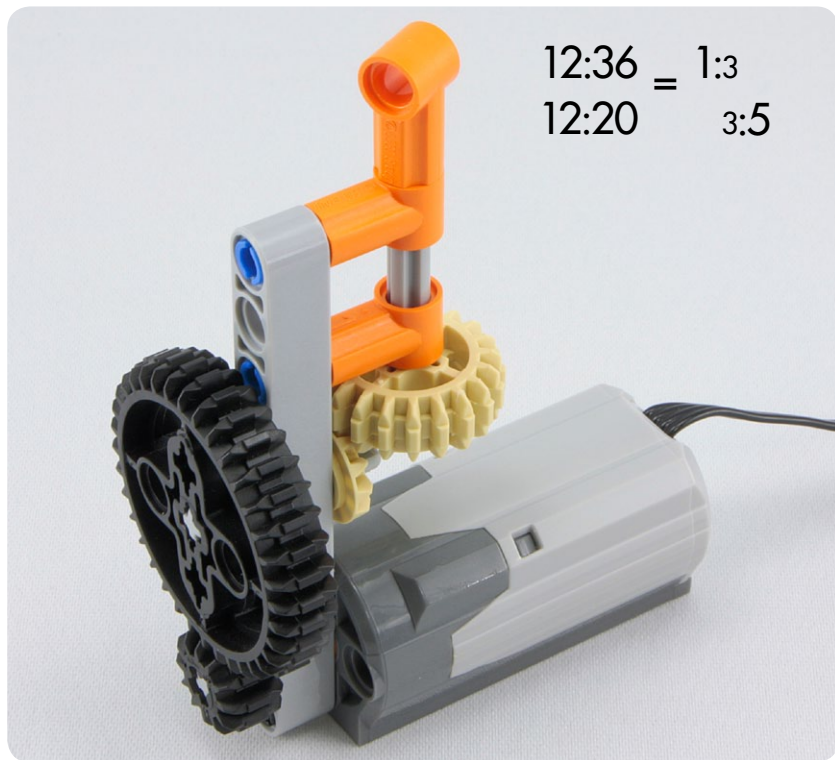
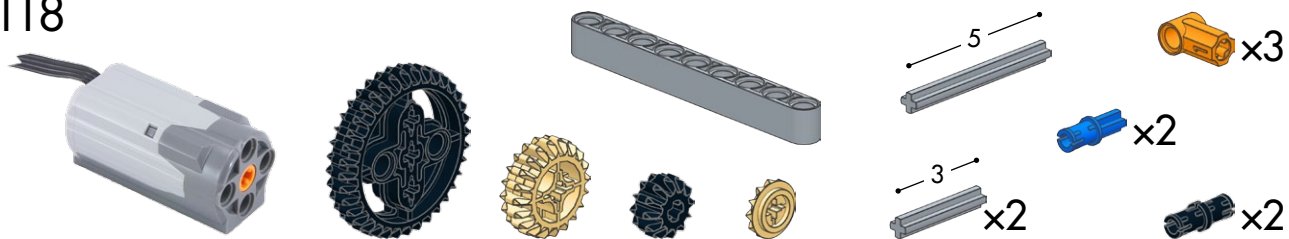


#117

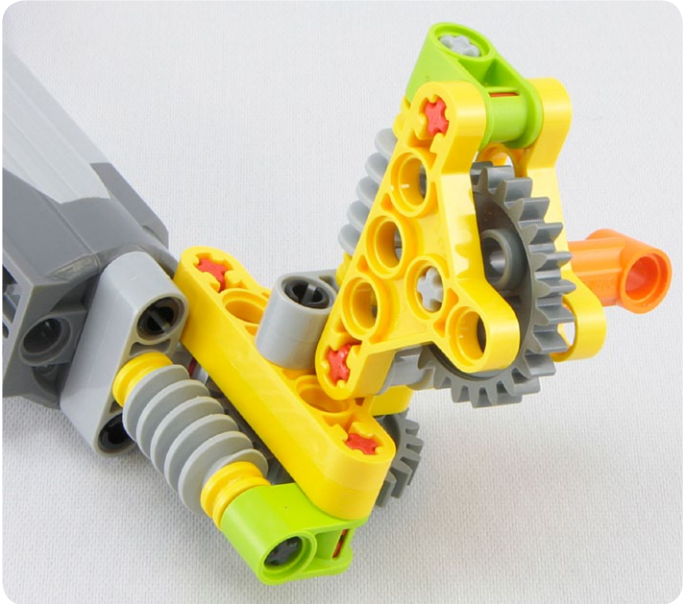
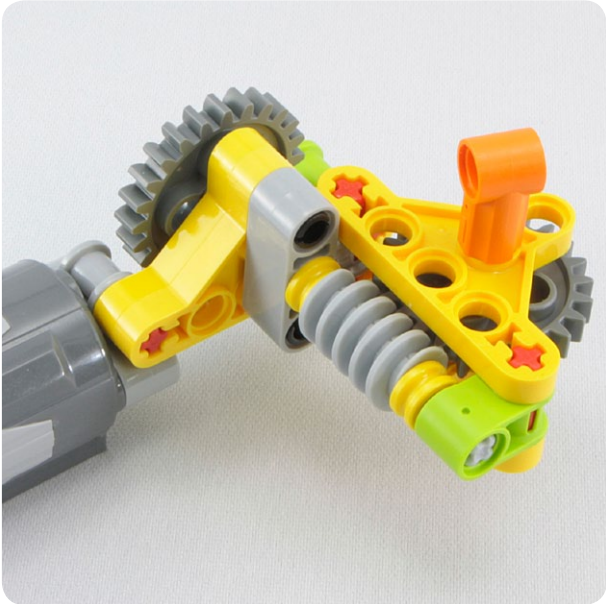
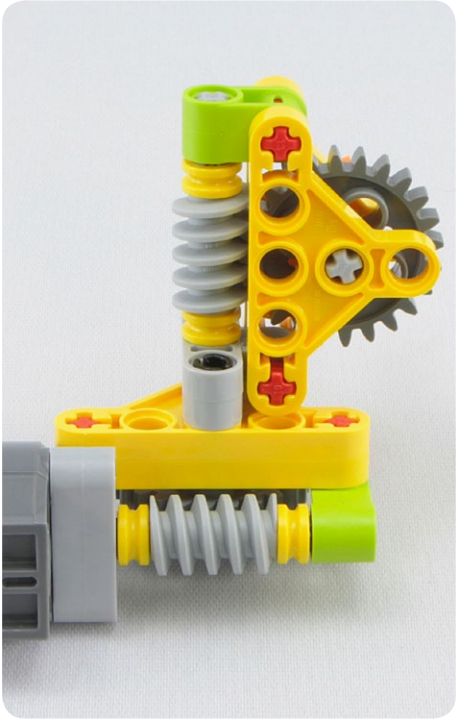
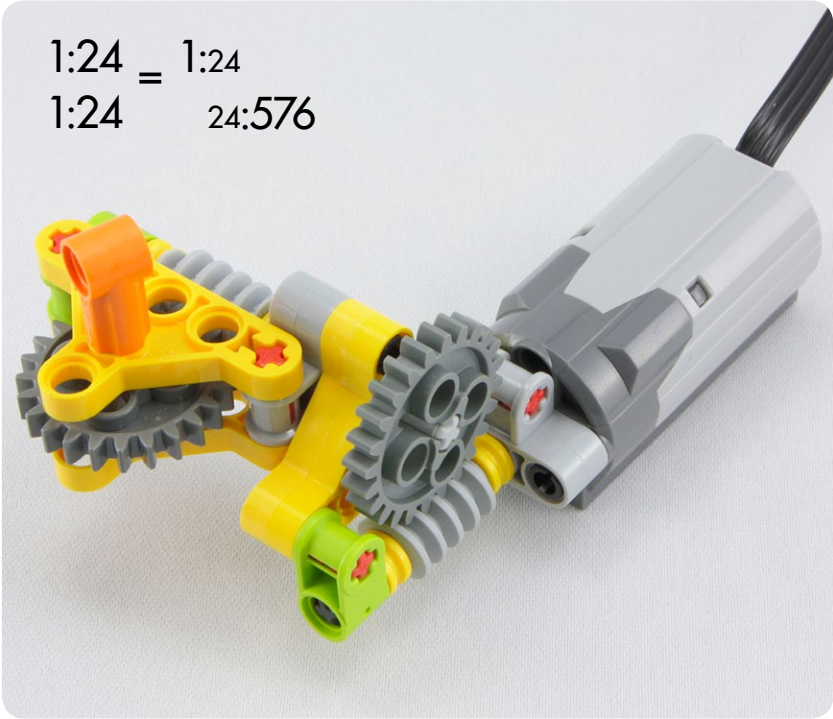
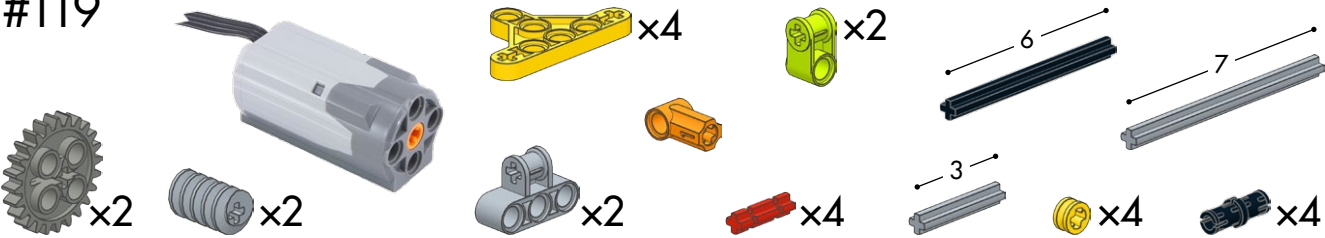
1 grey motor
2 orange 1x3 Technic bricks
1 yellow 1x5 Technic brick
2 grey 1/2 round Technic connectors
1 blue 1x3 Technic connector
1 green 1x3 Technic connector
1 orange 1x3 Technic connector
2 tan 24-tooth gears
1 black 24-tooth gear
1 tan 24-tooth gear
2 grey 3-hole Technic axles (labeled '3')
2 tan 3-hole Technic axles
1 grey 4-hole Technic axle (labeled '4')
2 blue 1/2 round Technic connectors
1 black 1/2 round Technic connector
2 blue 1x3 Technic connectors
8 black 1x3 Technic connectors



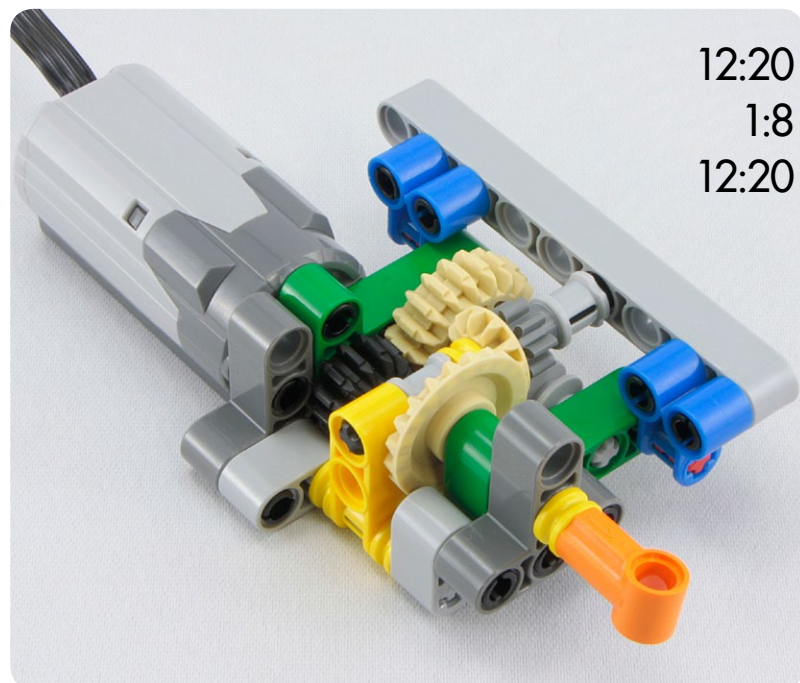
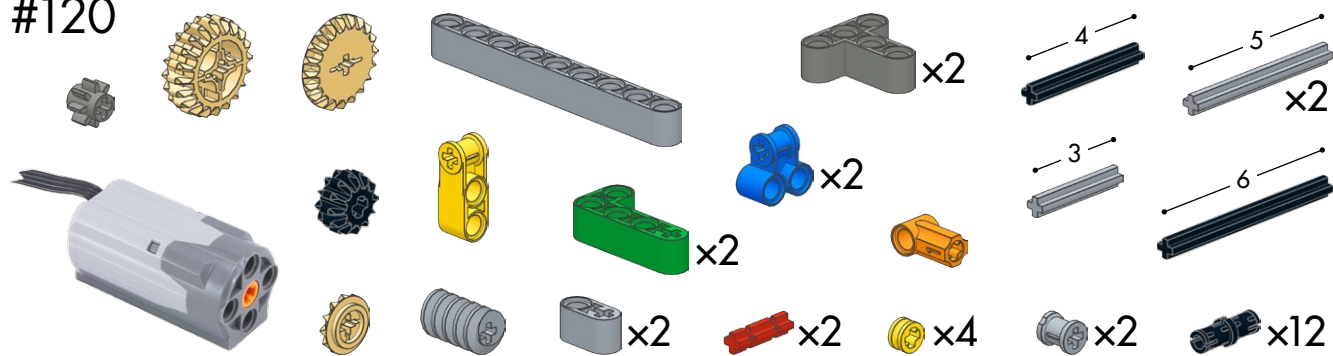
#118



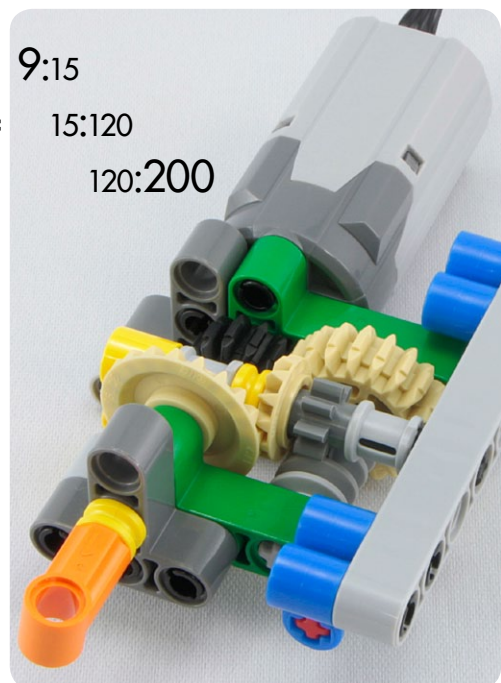
#119



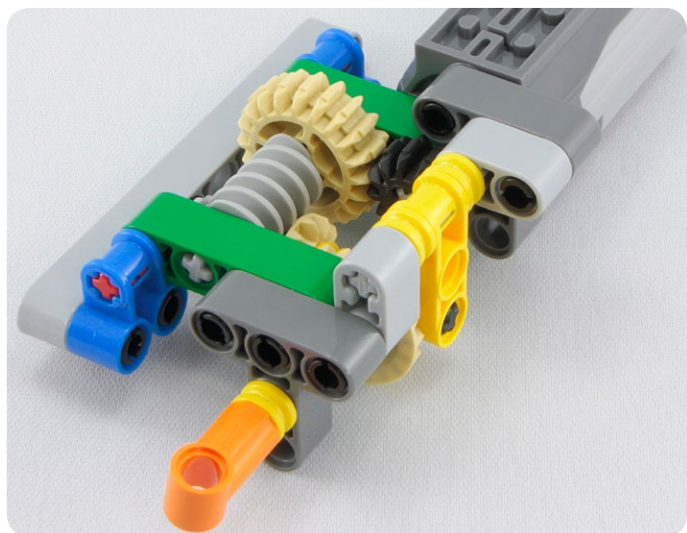
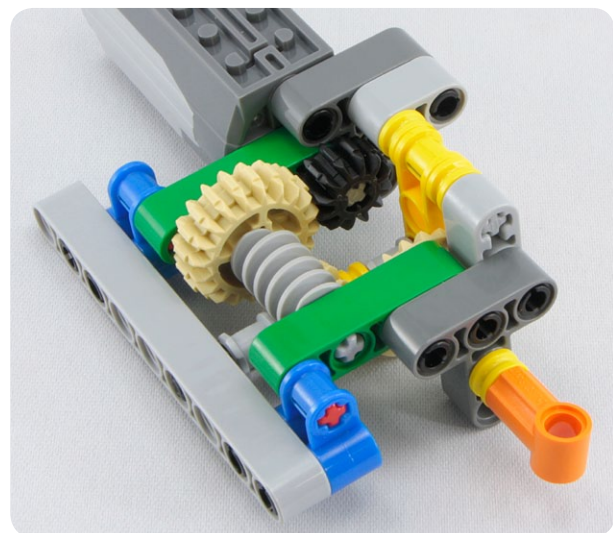
#120

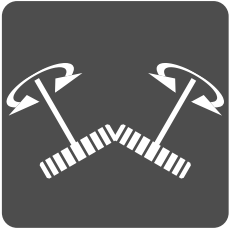


12:20
1:8 =
12:20



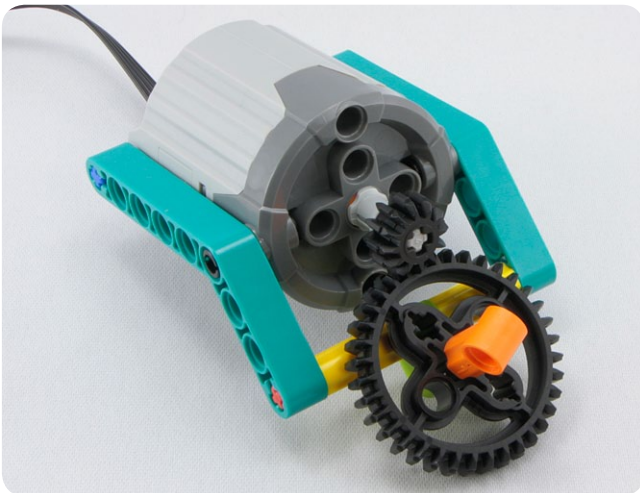
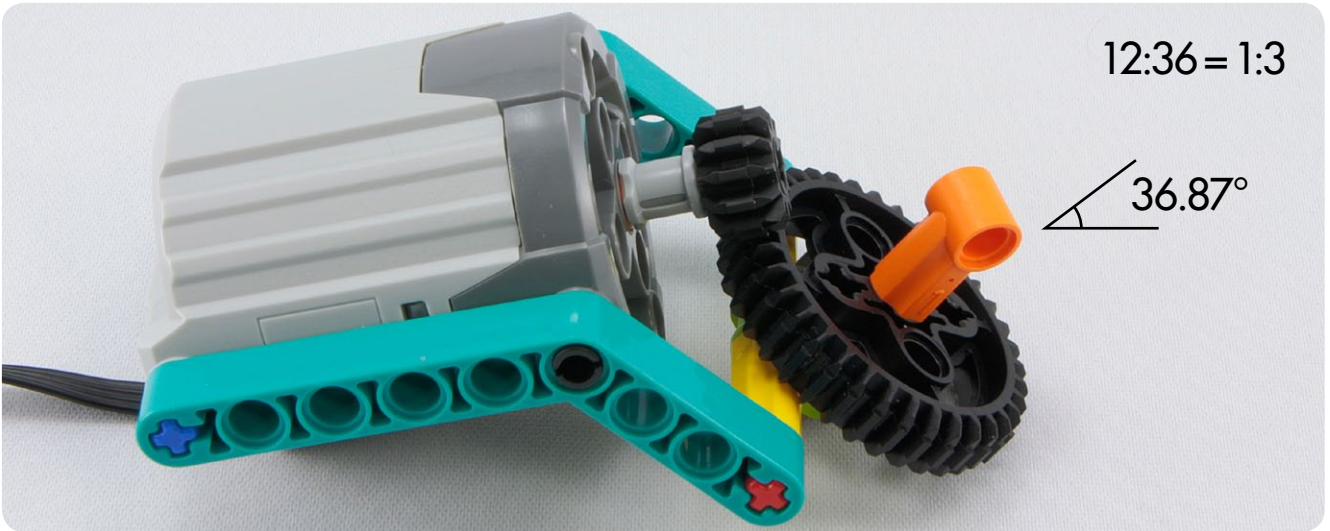
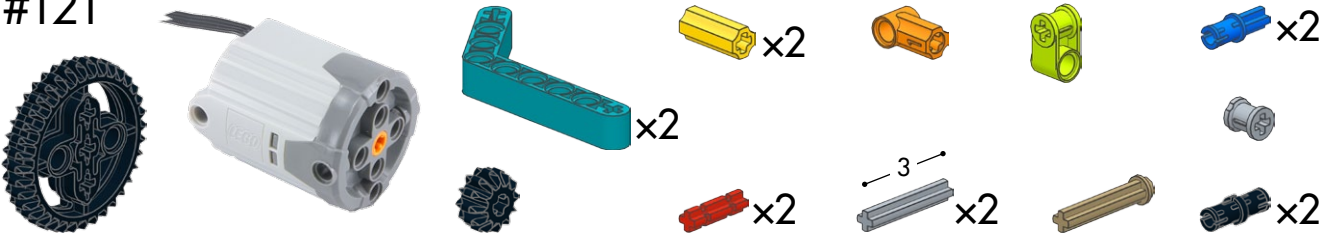
9:15
15:120
120:200



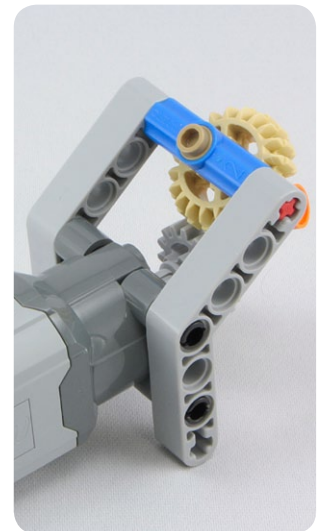
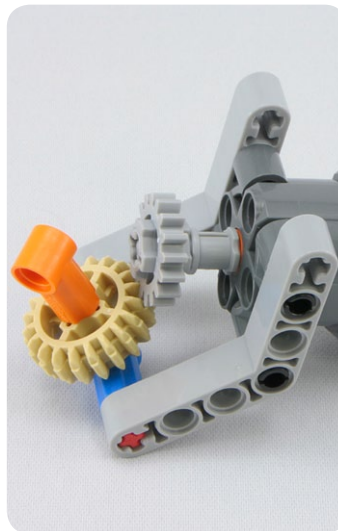
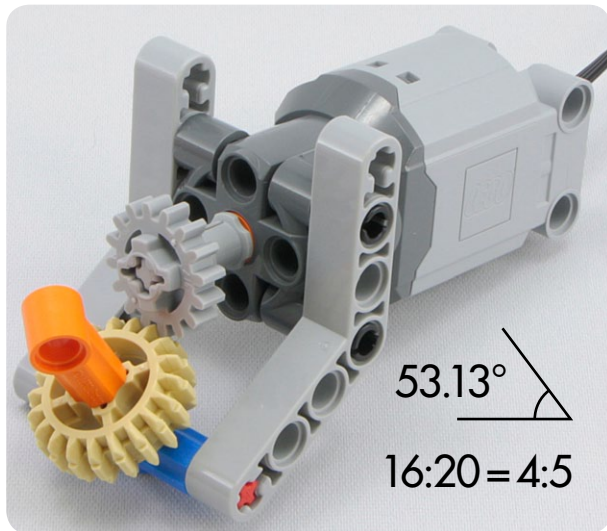
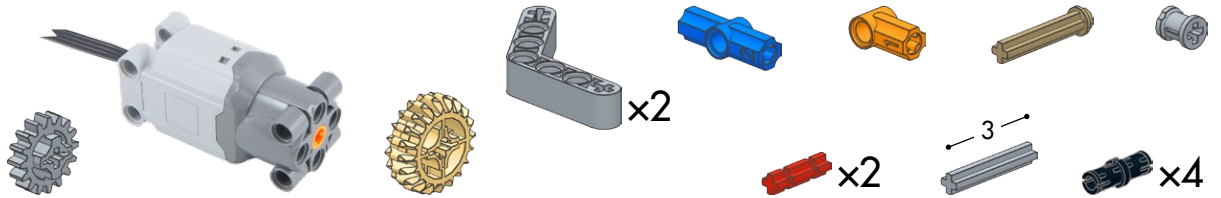


Tilting the angle of the axle

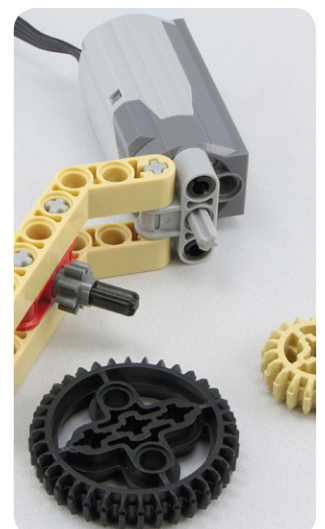
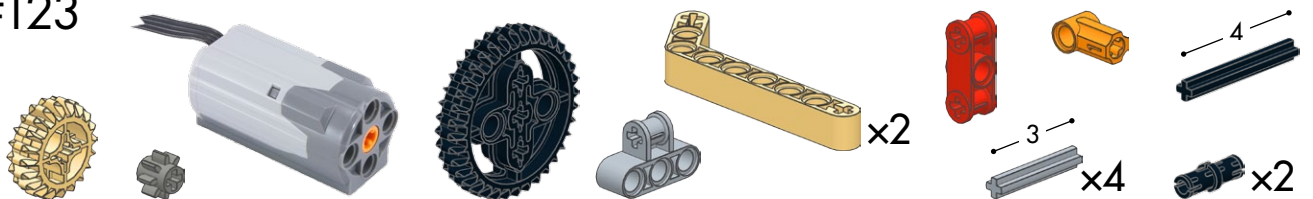
#121

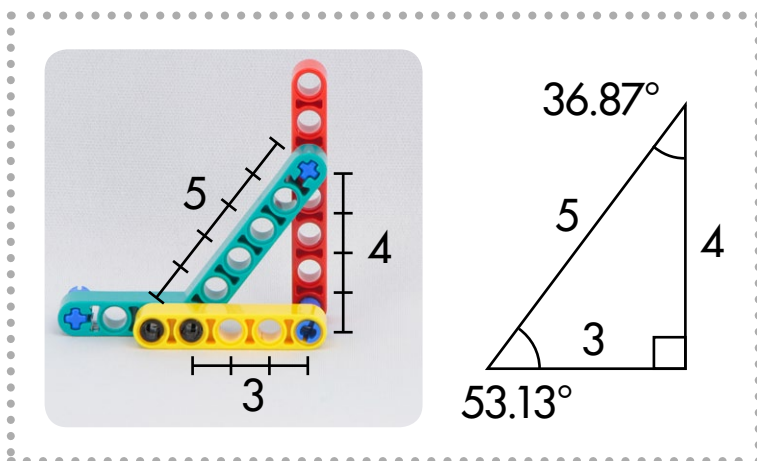
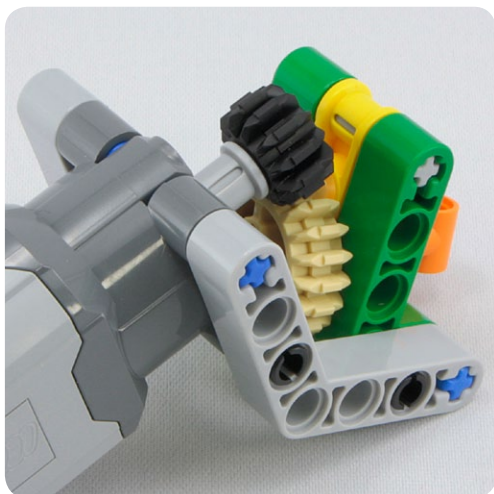
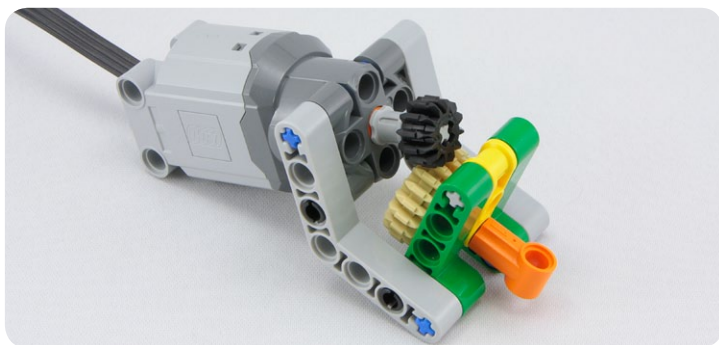
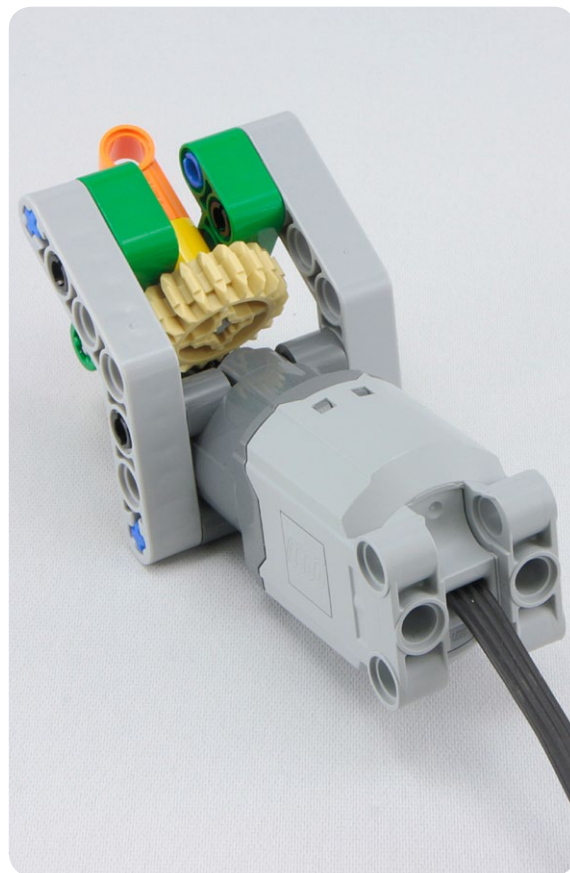


#122



#123



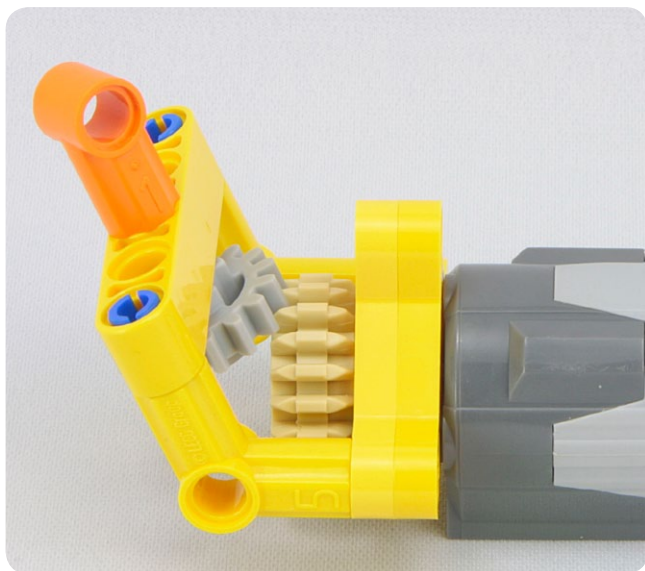
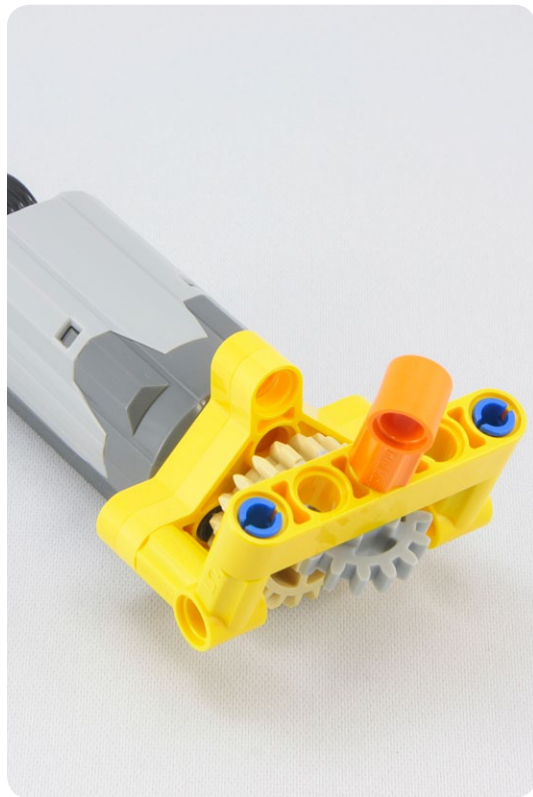
[illegible]

5

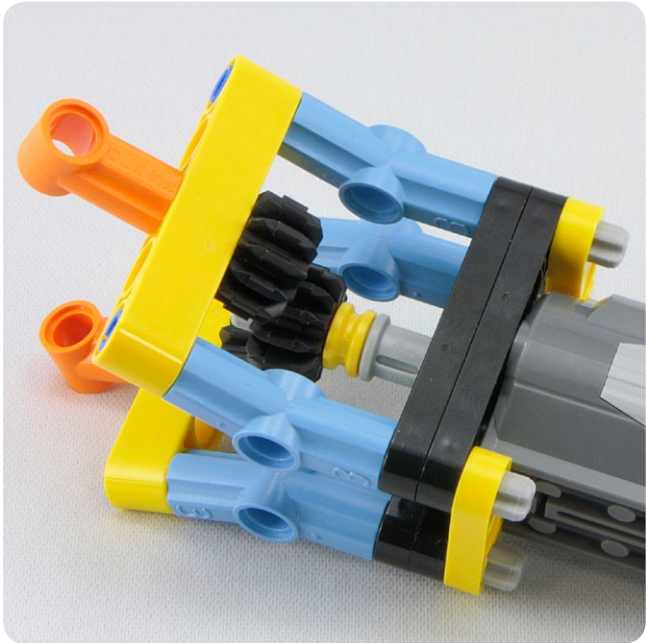
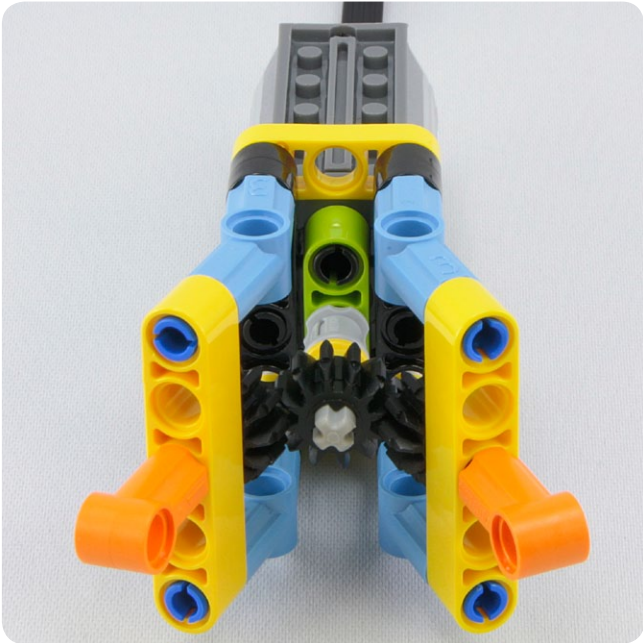
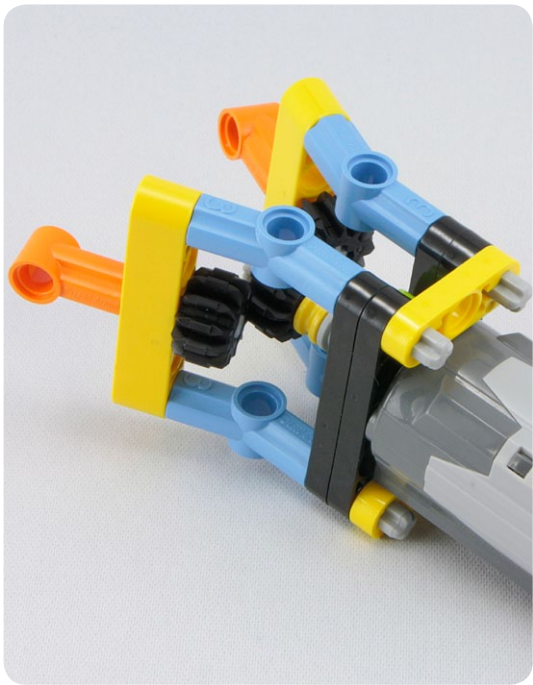
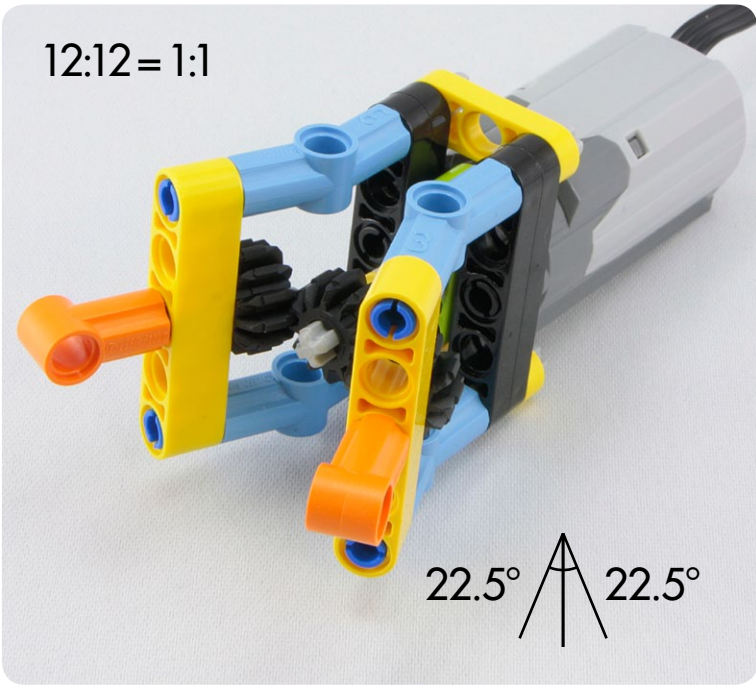
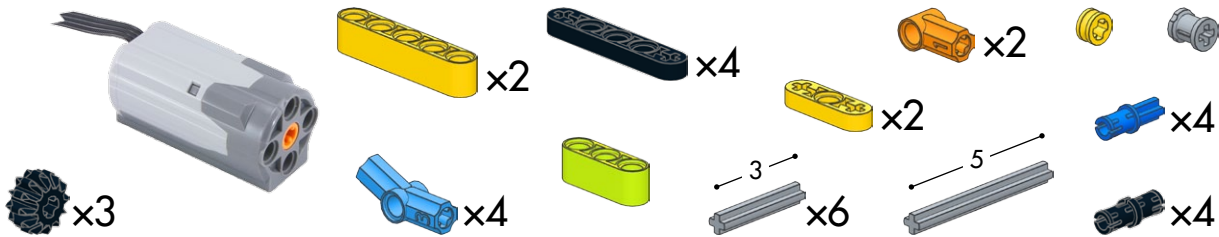


LEGO parts list for step 5:

- 1 grey motor
- 1 tan gear
- 1 yellow 1x5 Technic beam
- 1 grey gear
- 1 yellow 2x3 Technic L-Shape
- 1 orange 1x2 Technic axle connector
- 2 yellow 1x2 Technic L-Shape
- 2 red 1x2 Technic axle connector
- 2 yellow 1x2 Technic L-Shape
- 2 blue 1x2 Technic axle connector
- 2 grey 1x3 Technic axle
- 2 black 1x2 Technic axle connector



#126



2/



This image shows the parts list for step 2 of the assembly. It includes a large grey motor, a tan gear, a green L-shaped connector (x4), a yellow L-shaped connector (x4), a grey 3-way connector (x4), an orange 2-way connector (x4), a grey pin (x3), a red 2-way connector (x2), a grey 3-length axle (x3), a grey 4-length axle (x5), a yellow pin (x2), and a black 2-way connector (x2).

x5

x4

x4

x4

x4

x3

x2

3

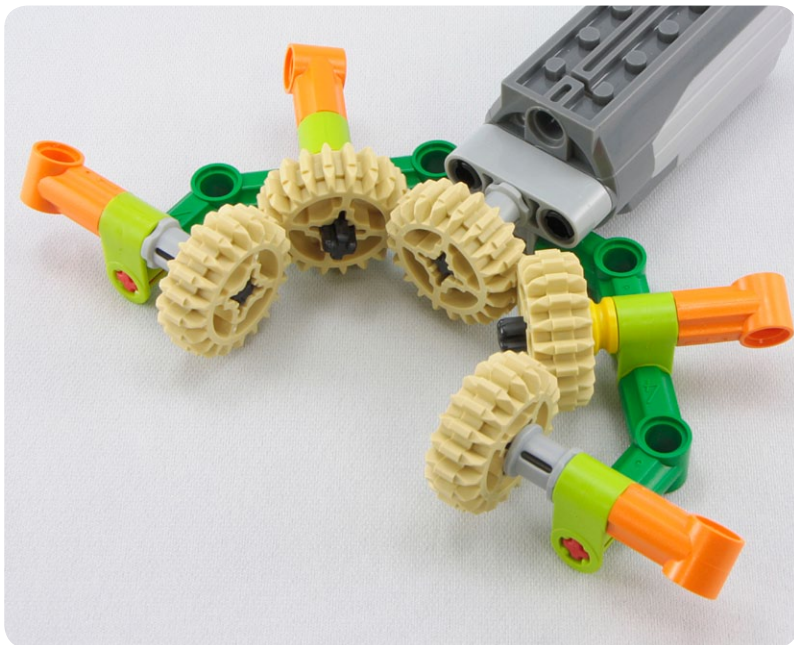
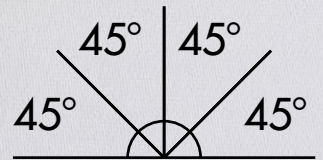
x3

4

x5

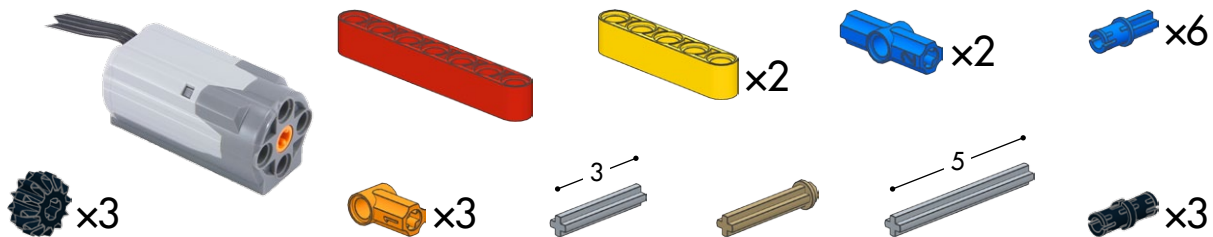
x2

x2

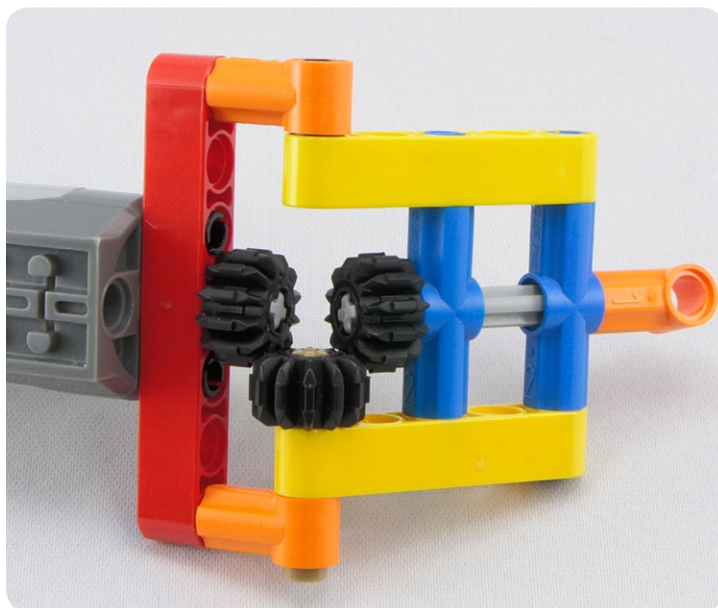
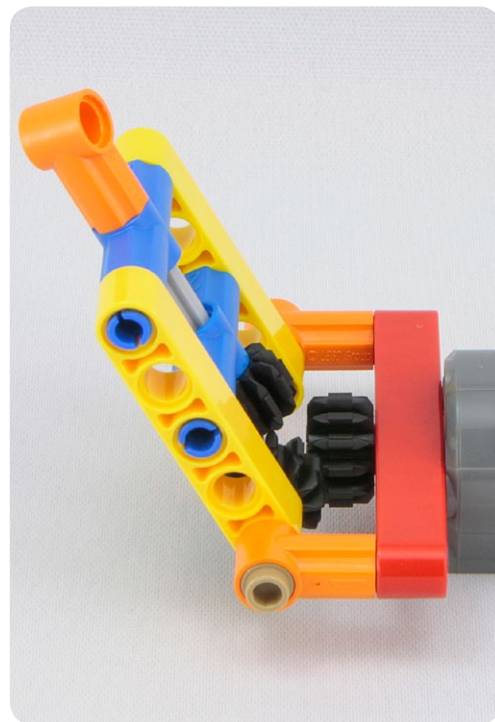




#129

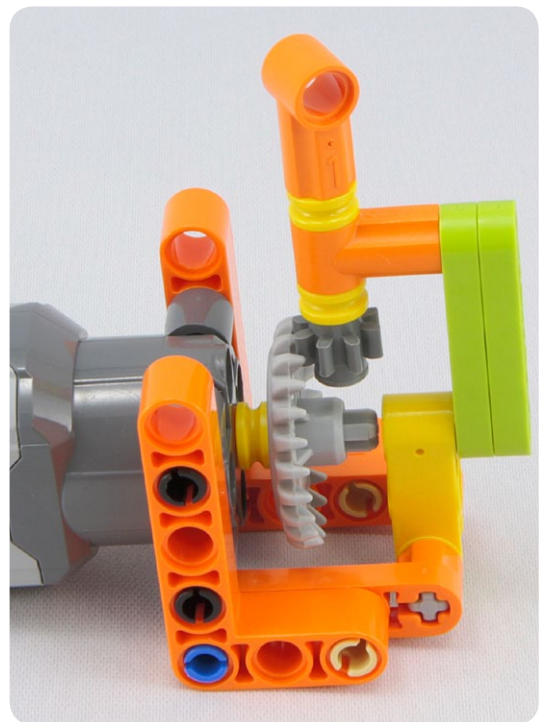


12:12:12 = 1:1:1

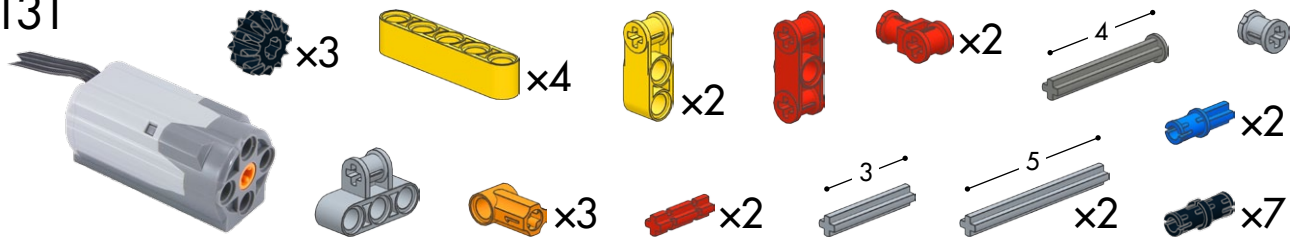
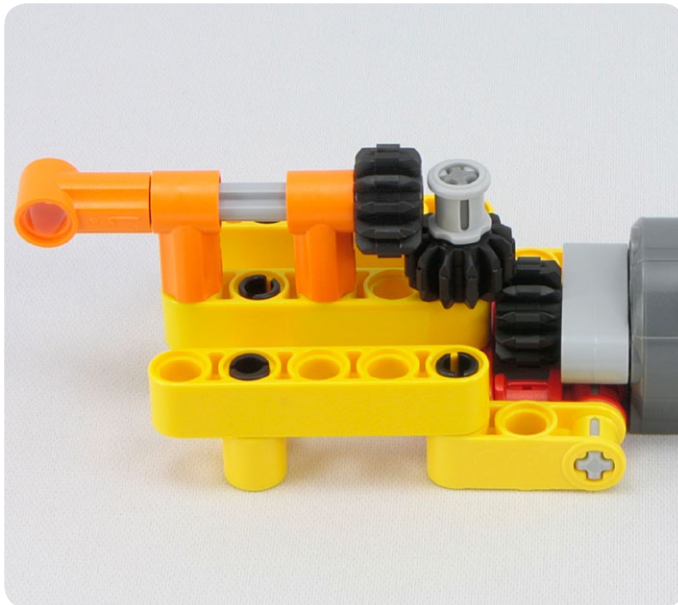
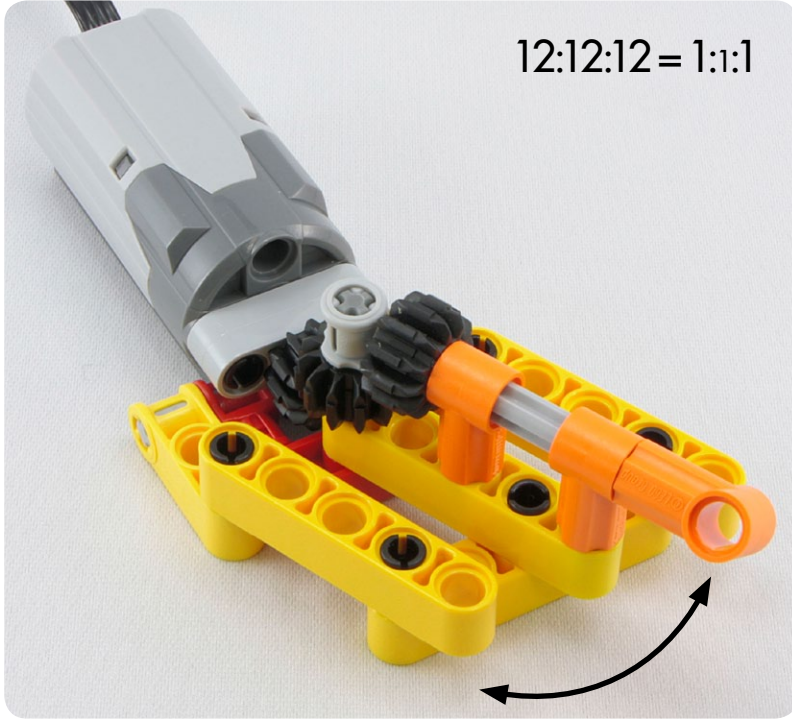


#130

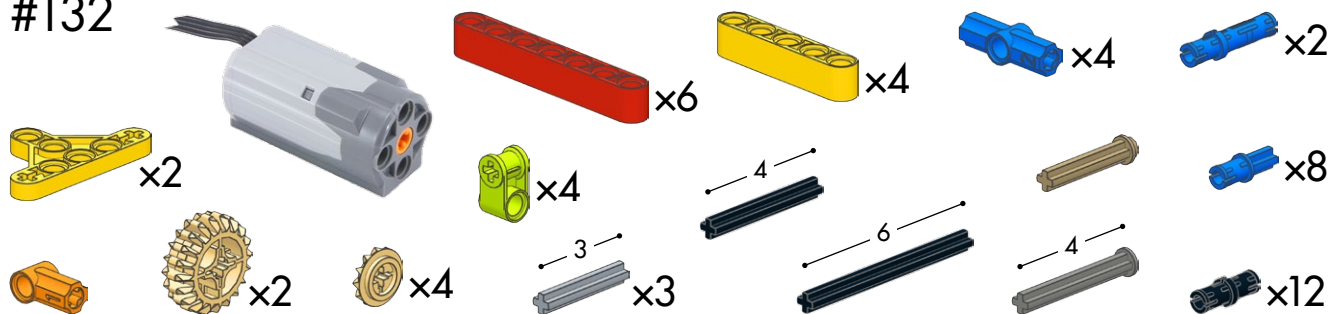
1 grey motor, 1 grey gear, 1 grey connector, 2 orange 1x3 Technic bricks, 1 yellow 1x3 Technic brick, 2 orange 1x3 Technic bricks with a pin, 2 green 1x3 Technic bricks, 2 tan pins, 2 blue pins, 3 yellow pins, 2 grey pins of length 3, 4 grey pins of length 4, 2 orange pins, 1 red pin, and 4 black pins.



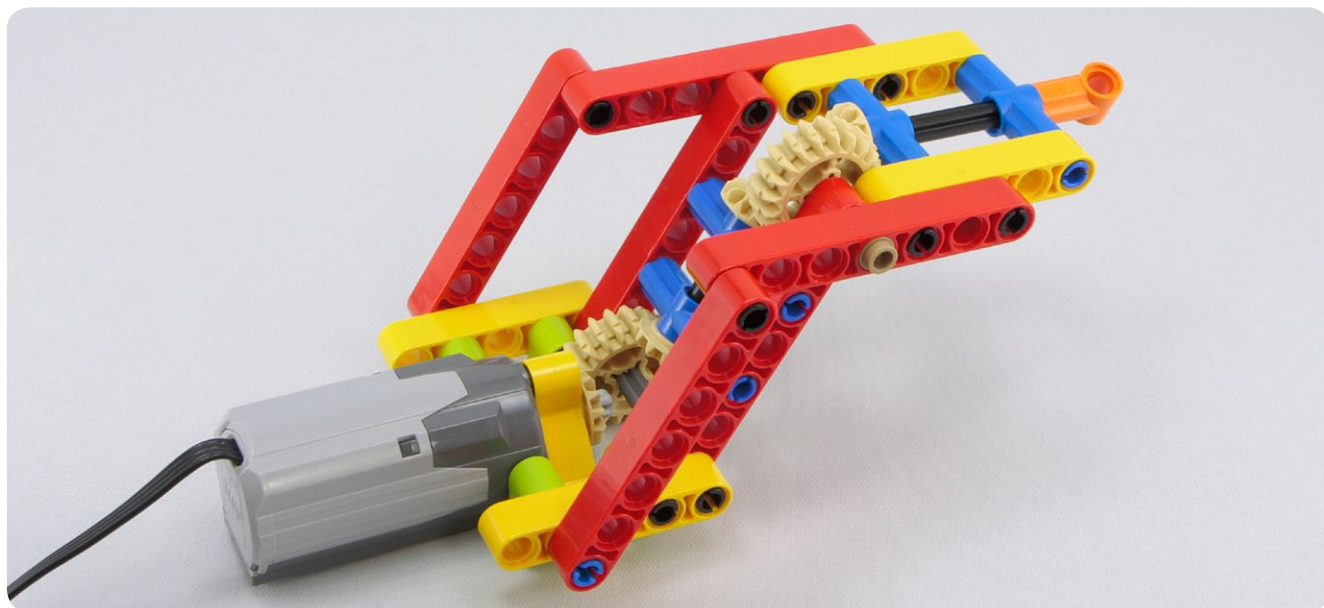
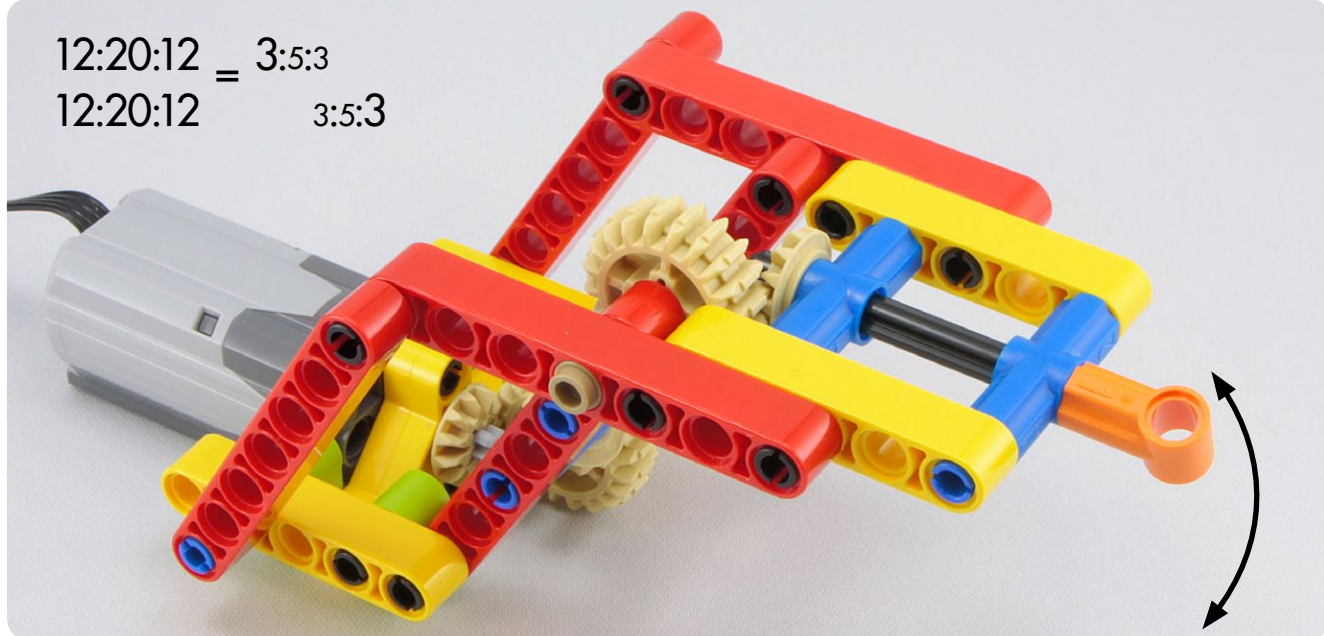
#131

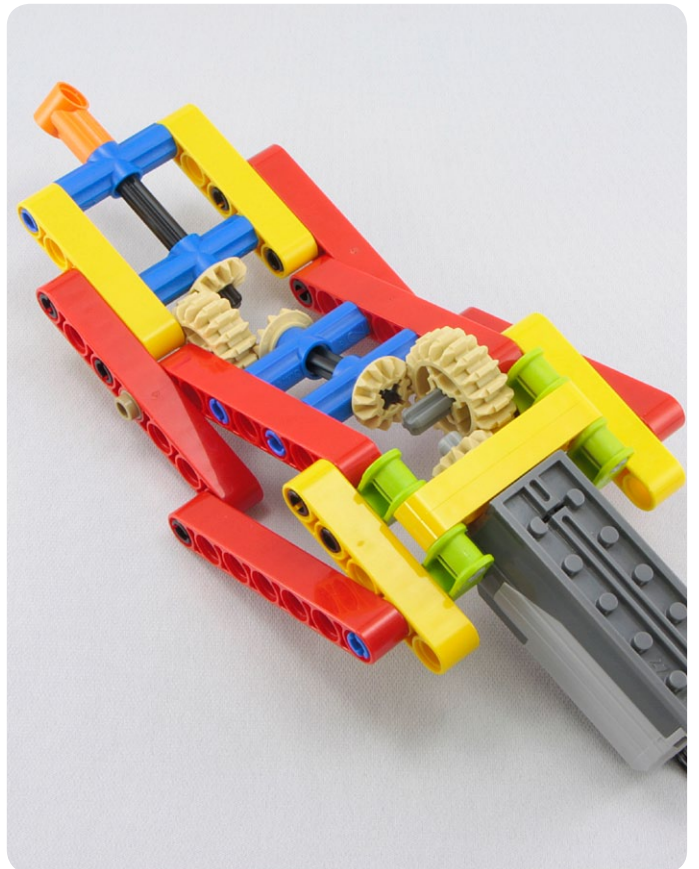
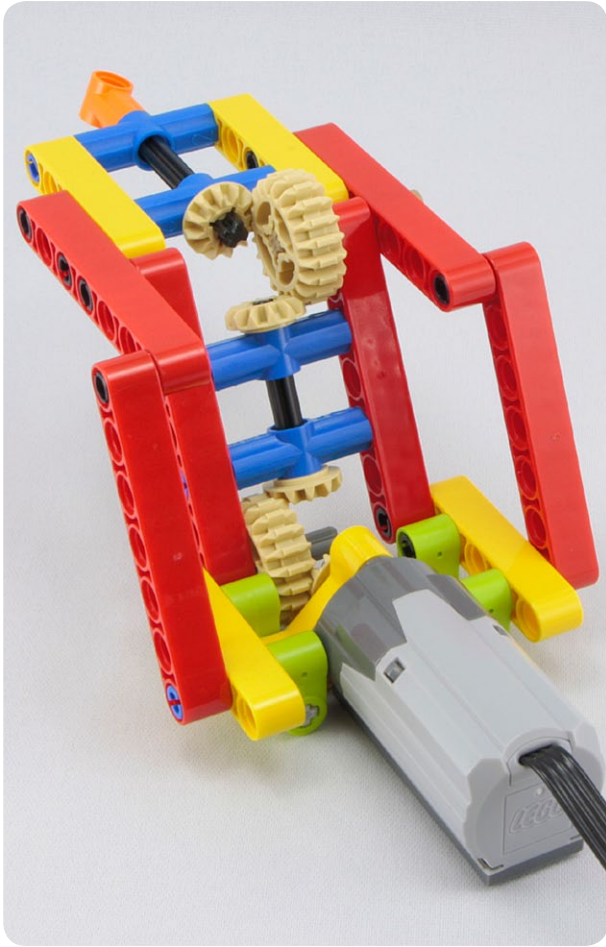

$$12:12:12 = 1:1:1$$


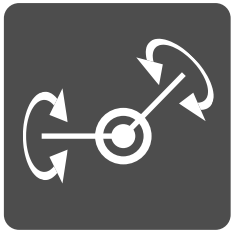
#132



12:20:12 = 3:5:3
12:20:12 3:5:3

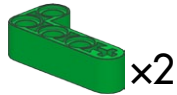




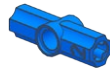


Universal joints

#133



x2



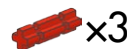
x2



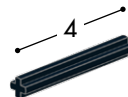
x3



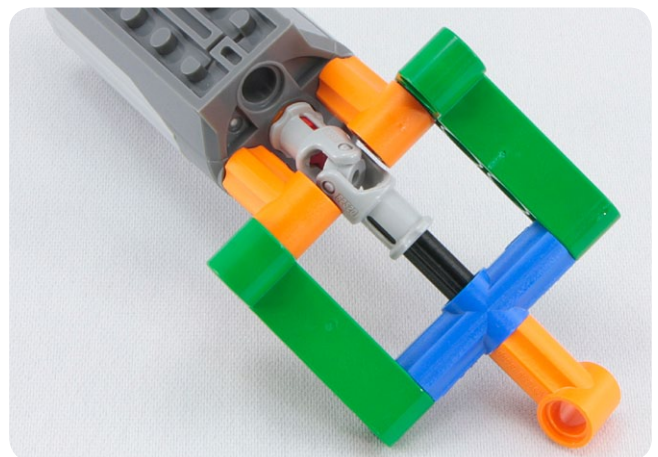
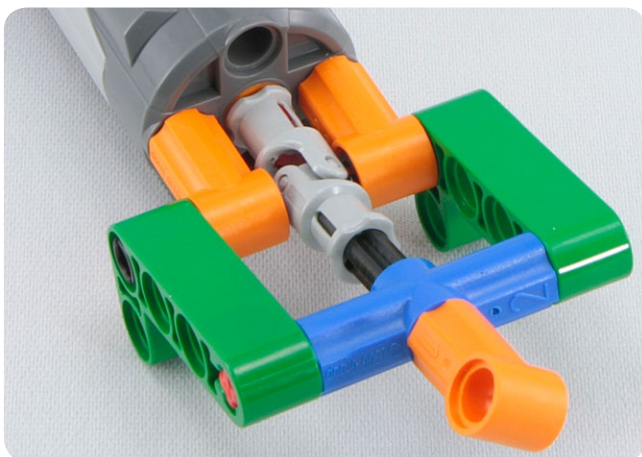
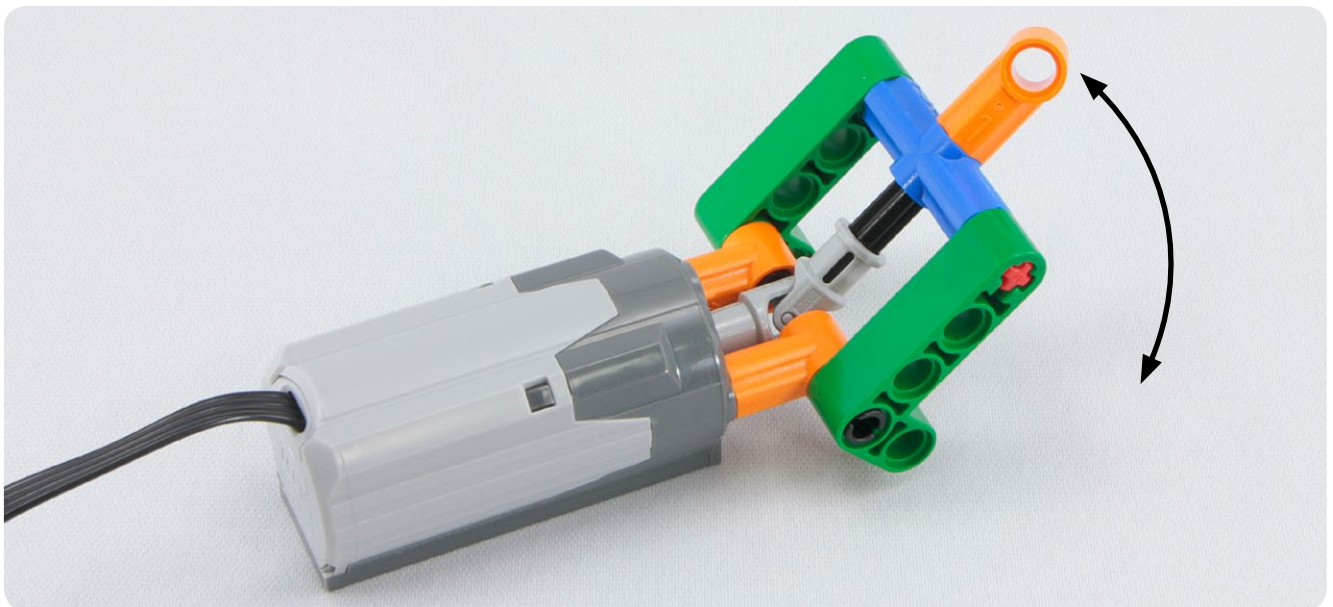
x2



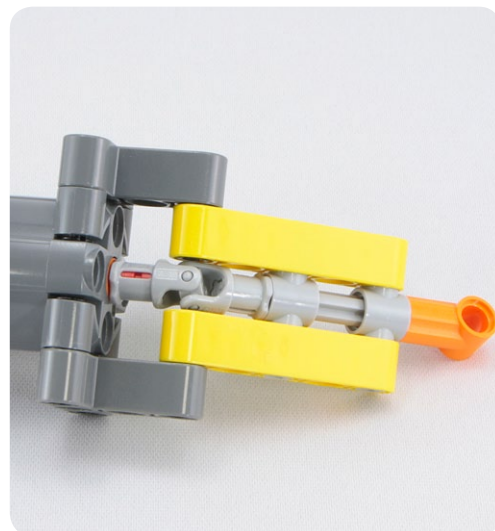
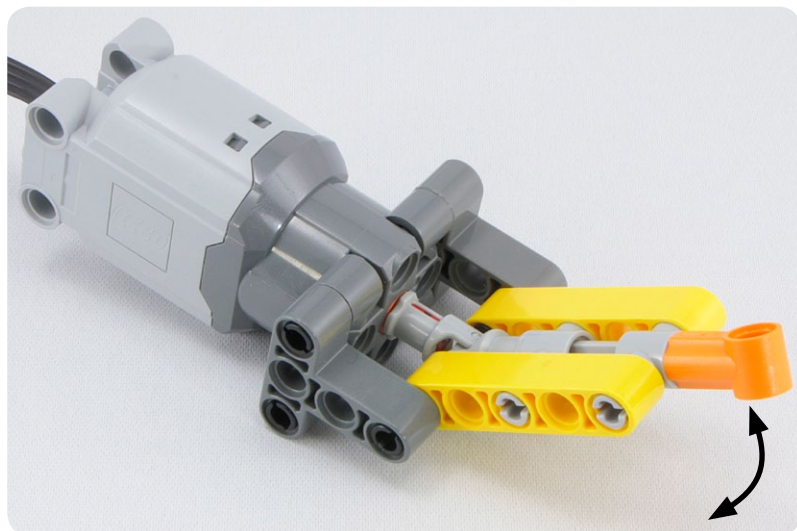
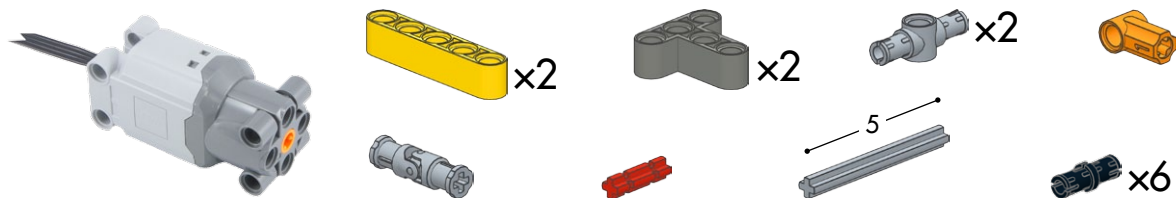
x3



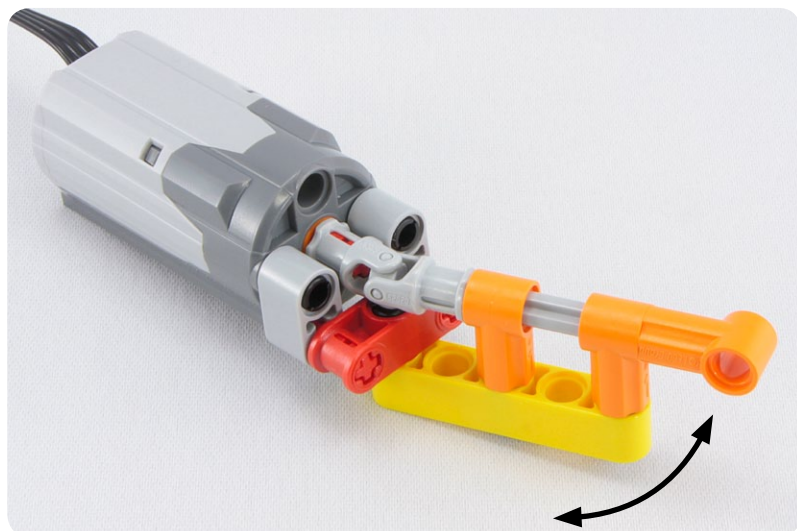
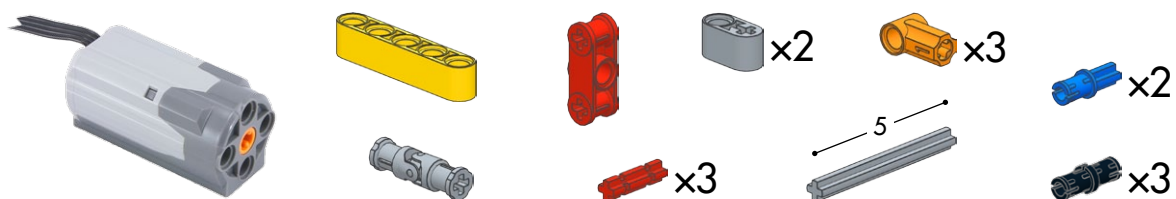
4



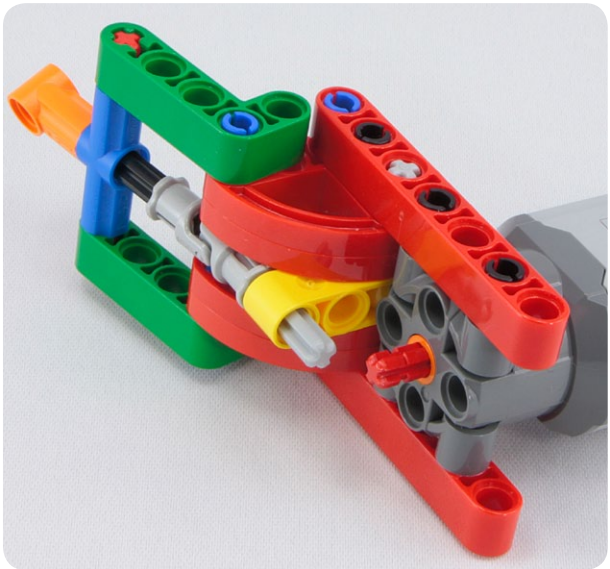
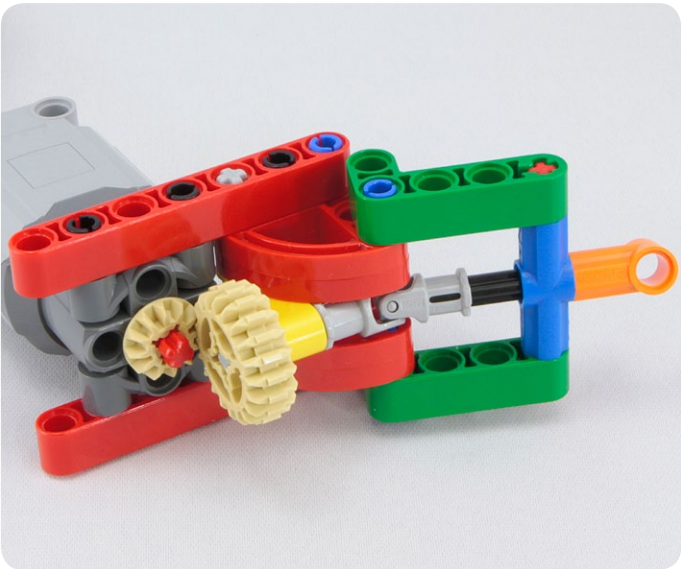
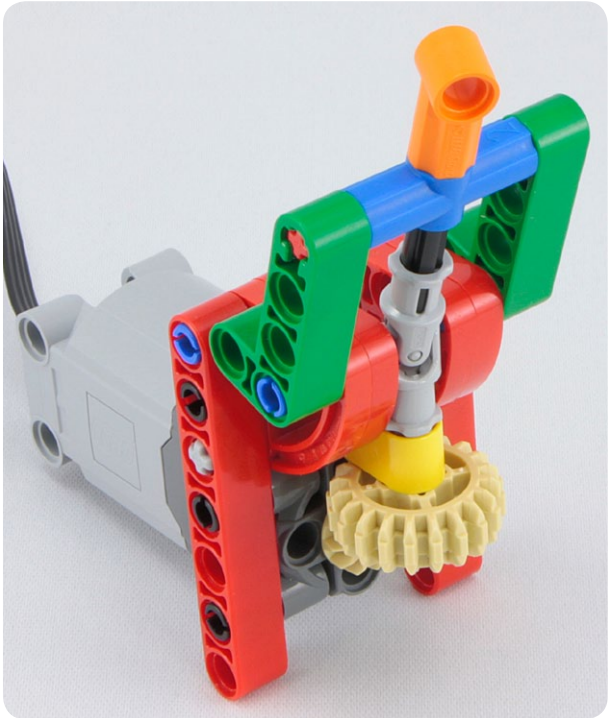
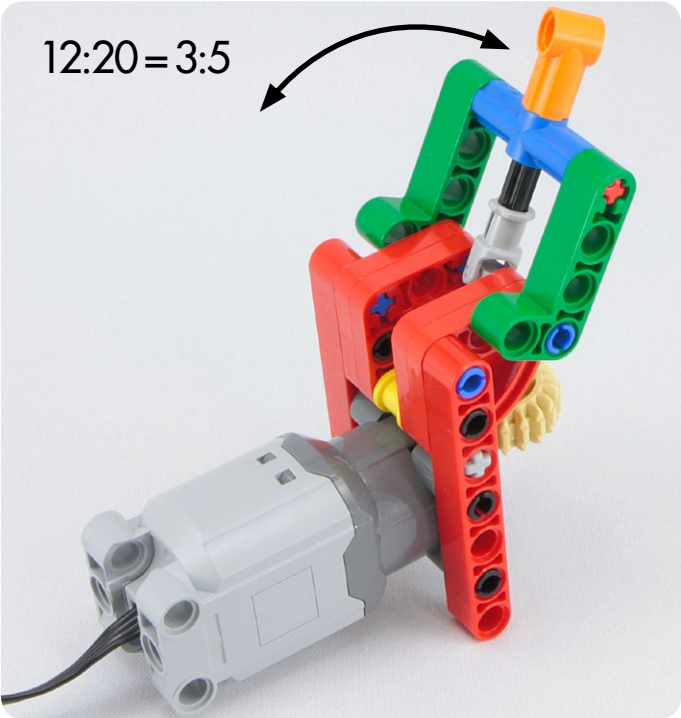
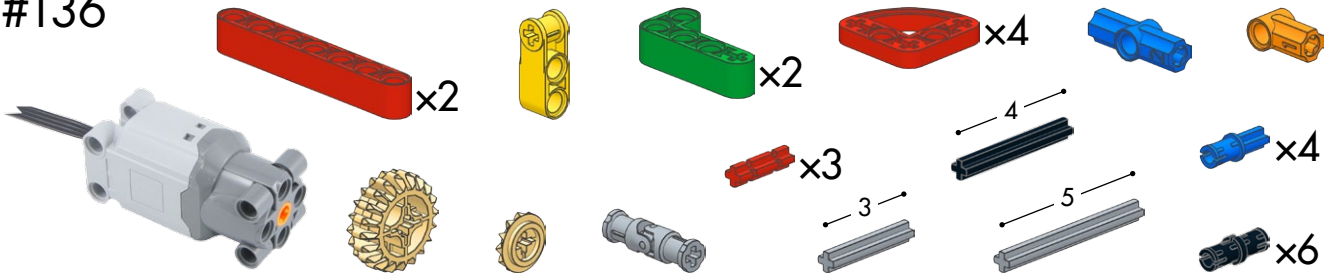
#134



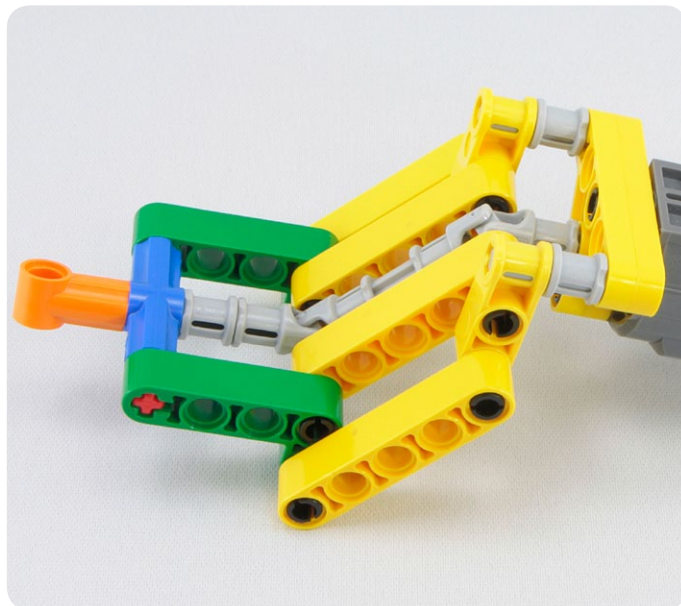
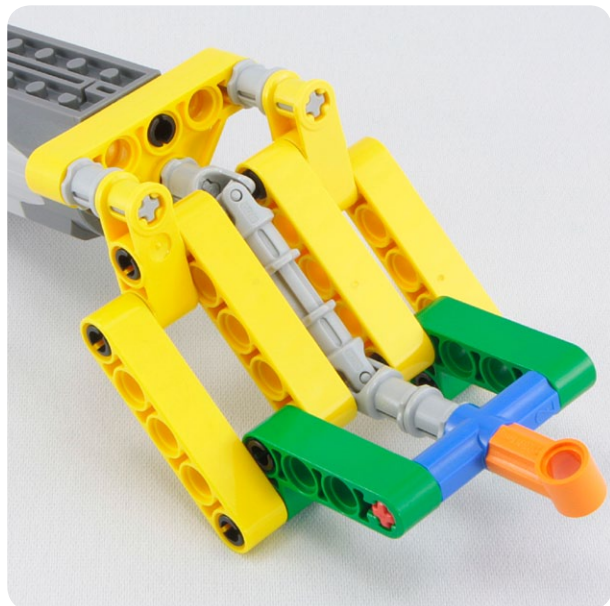
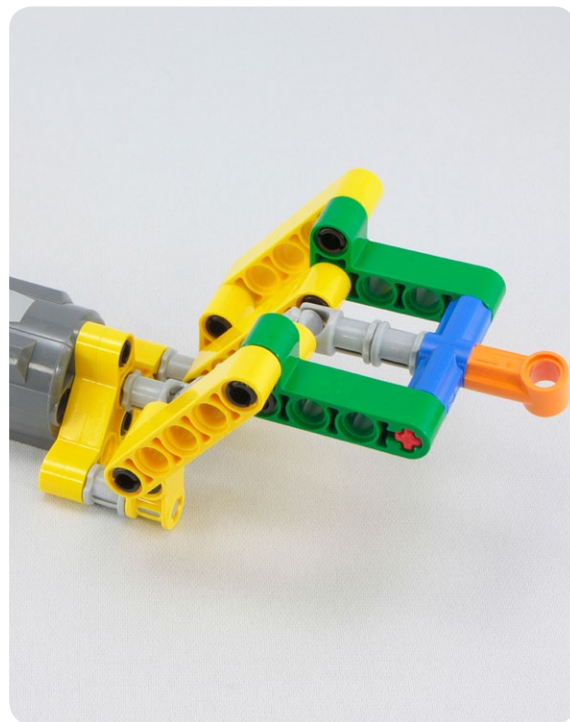
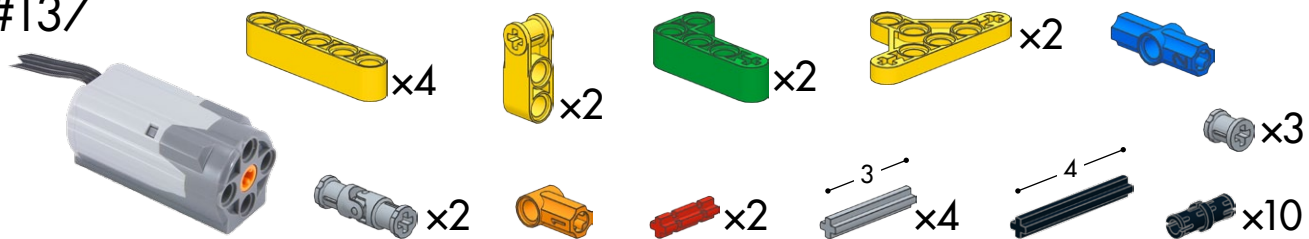
#135



#136

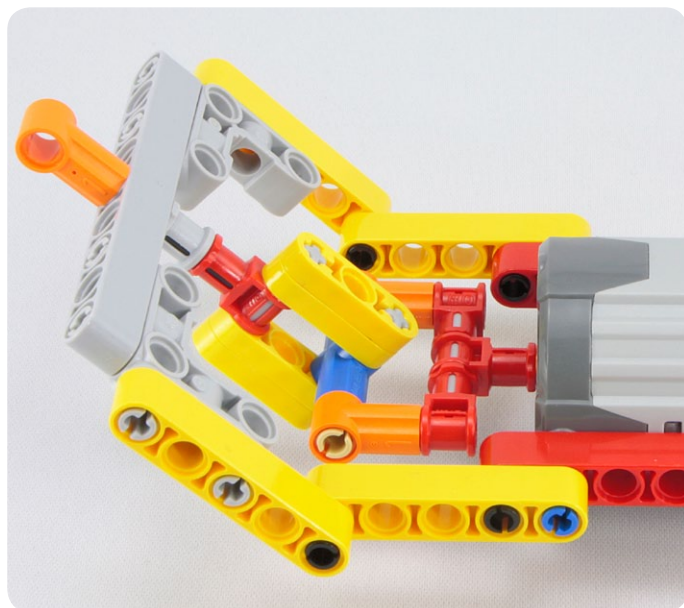
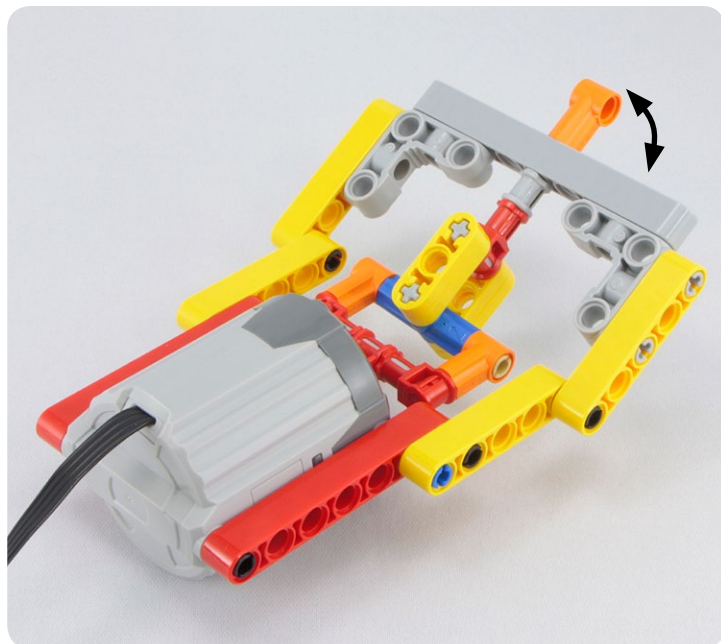
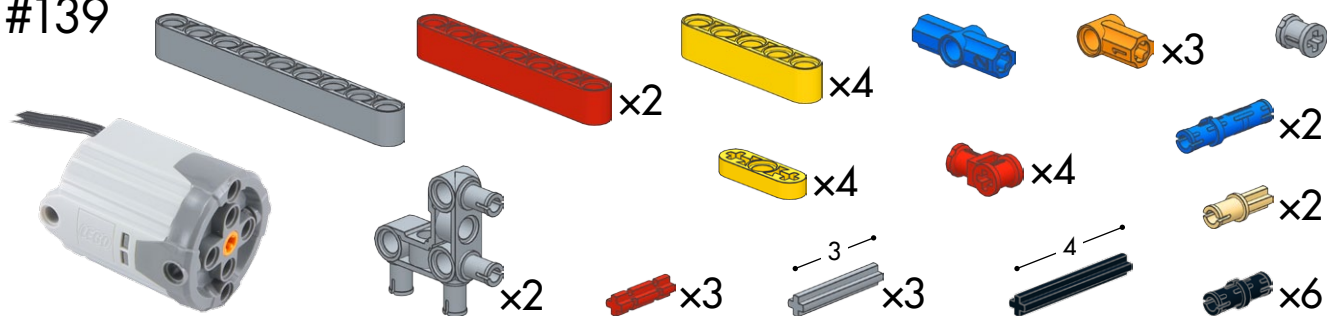


#137

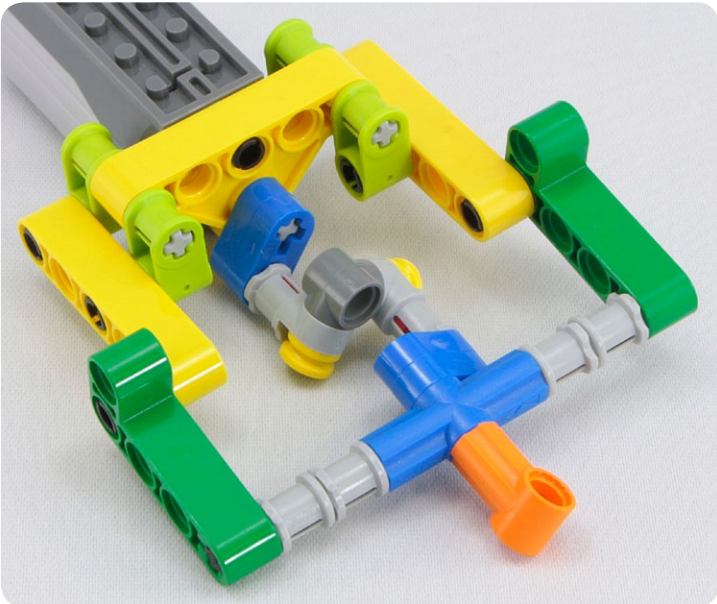
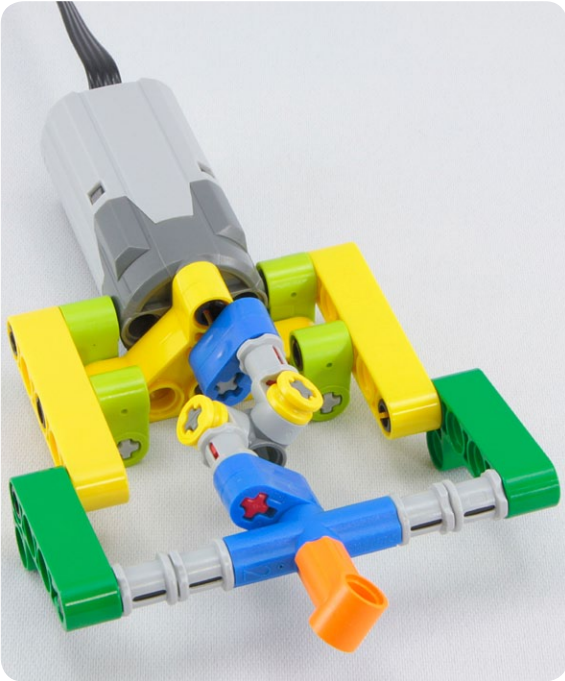
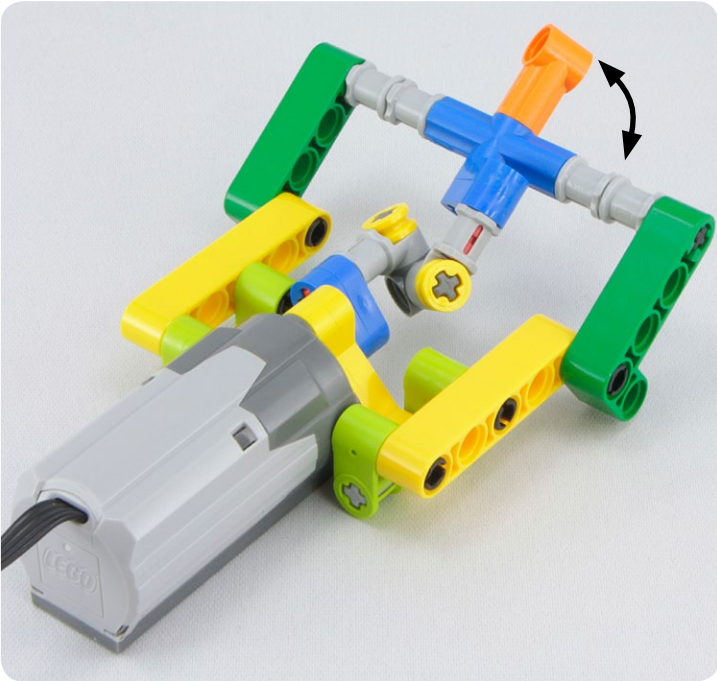
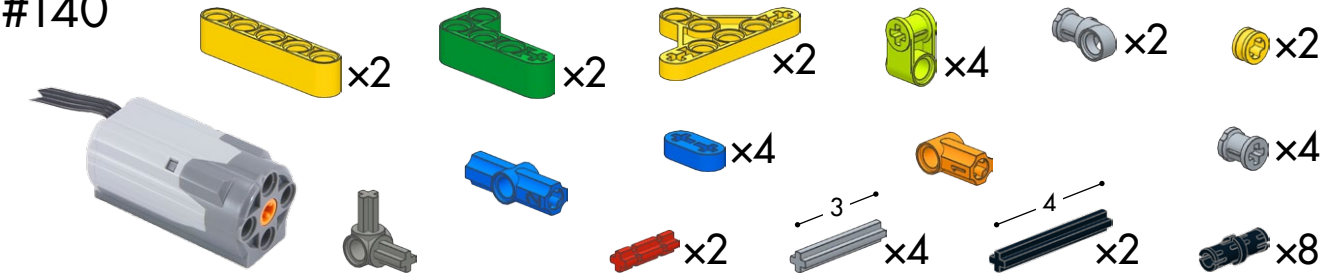


[illegible]

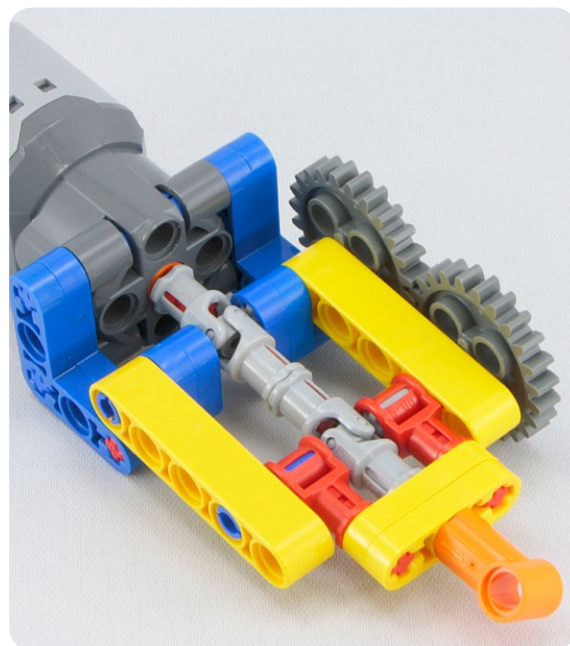
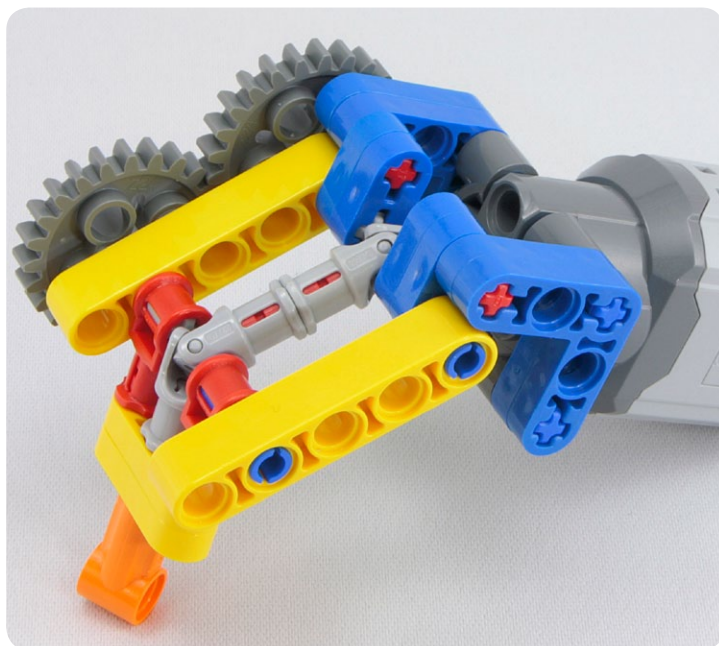
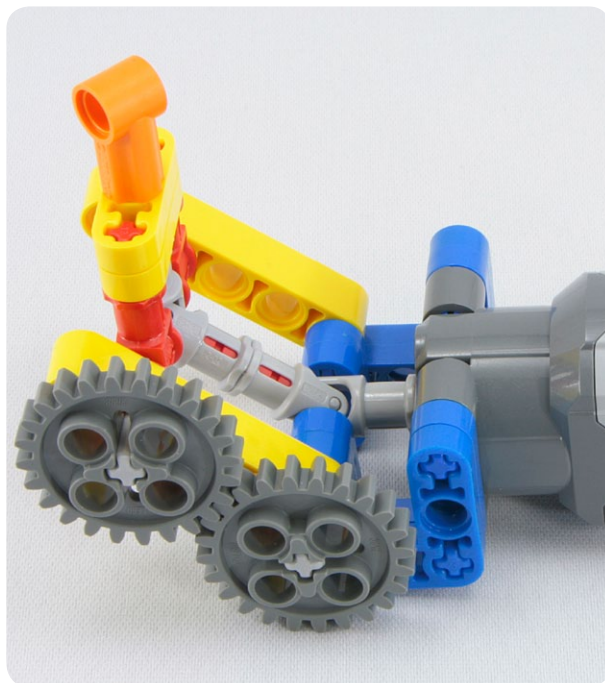
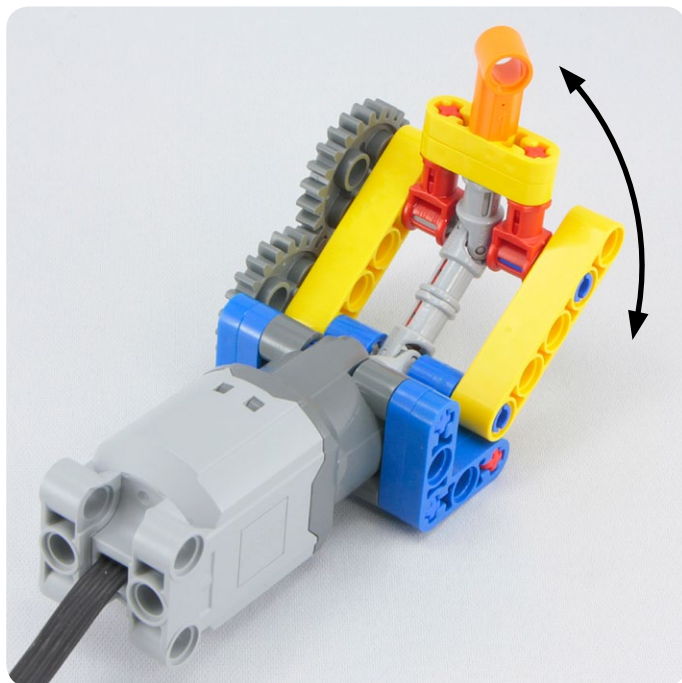
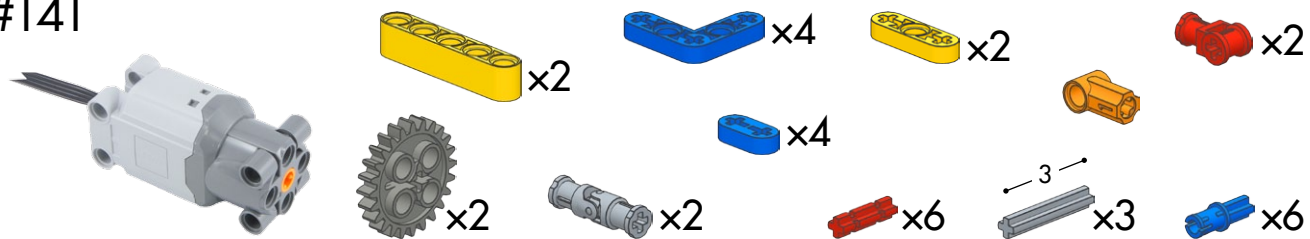
#139



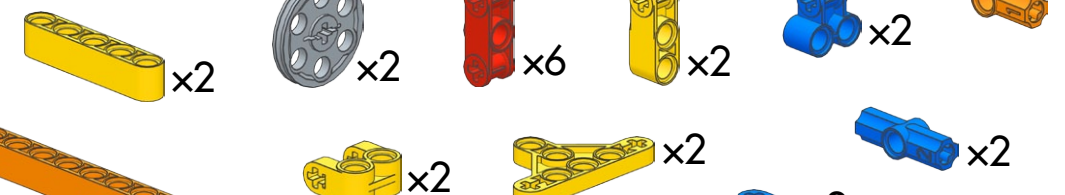
#140



#141

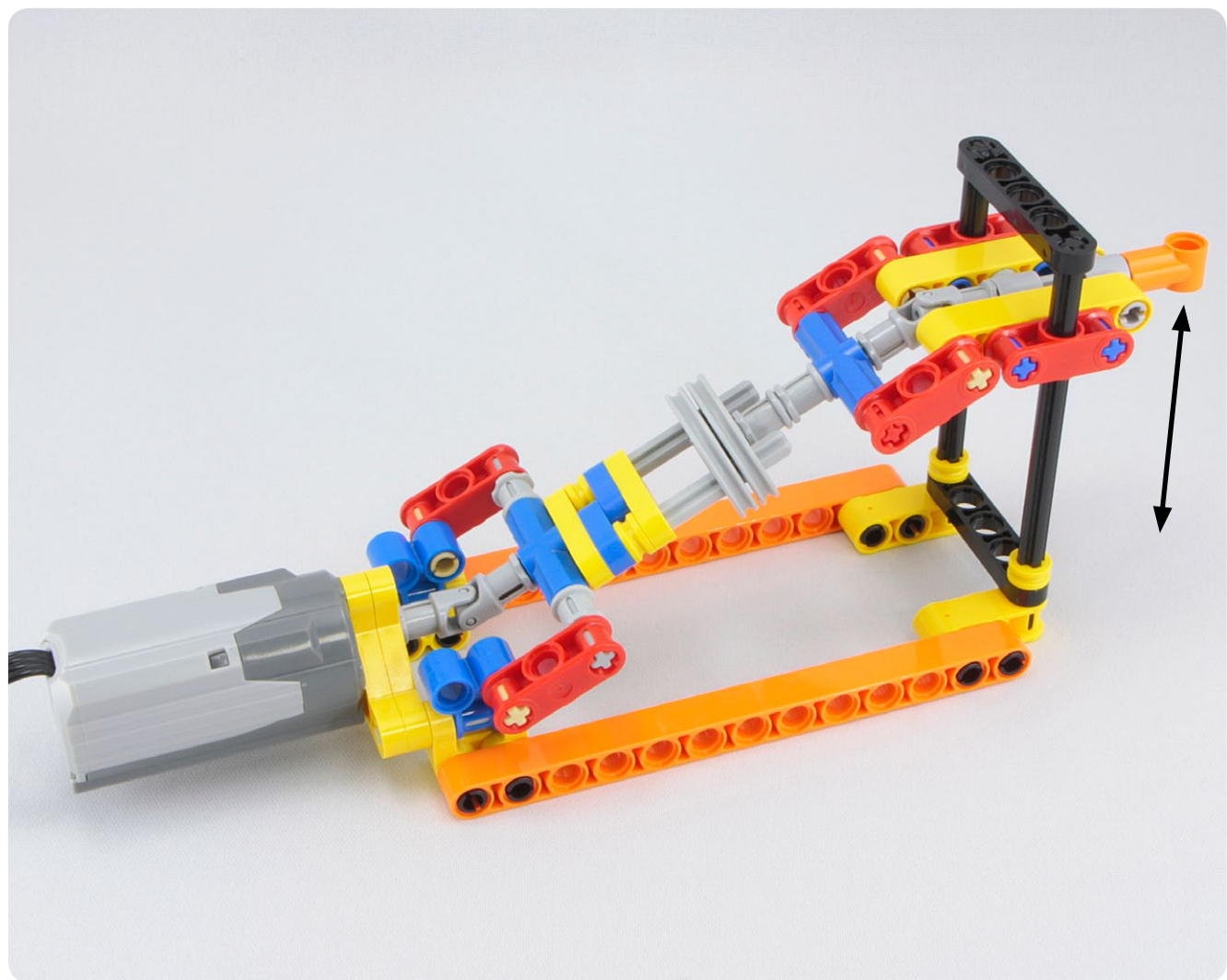


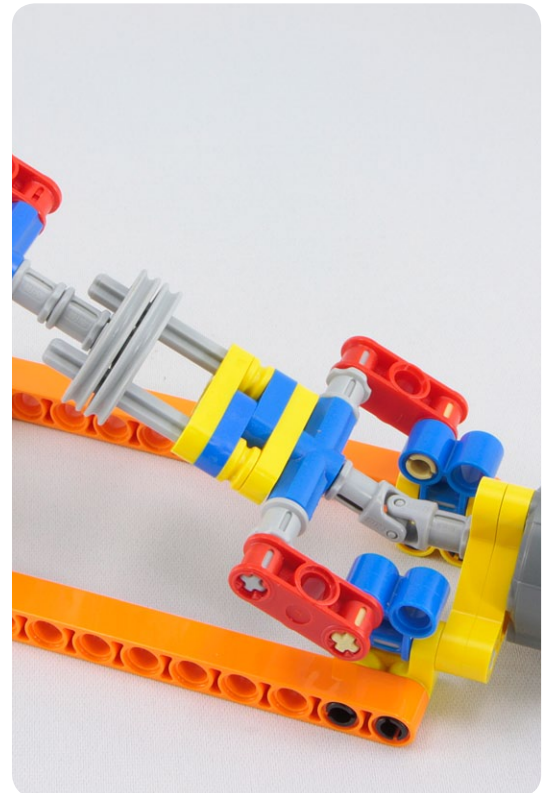
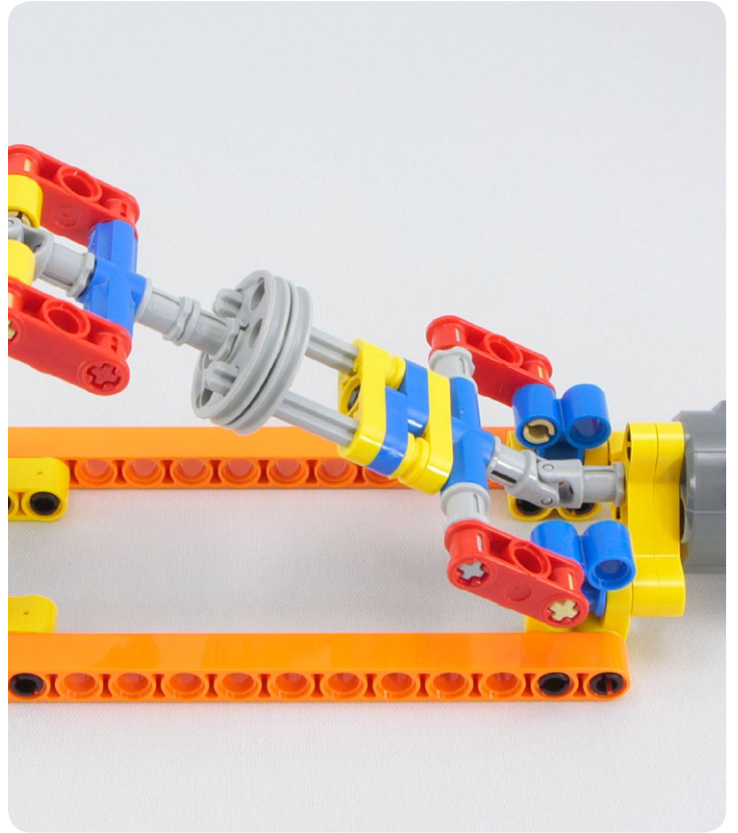
#142

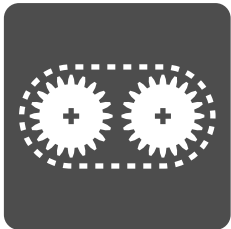


This image displays the parts list for step 142. The parts are arranged in a grid-like fashion, with each part shown in its original color and quantity indicated by a number. The parts include:

- 1 yellow 1x5 Technic beam (x2)
- 1 grey 1x5 Technic wheel (x2)
- 1 red 1x3 Technic axle (x6)
- 1 yellow 1x3 Technic axle (x2)
- 1 blue 1x3 Technic axle (x2)
- 1 orange 1x3 Technic axle (x2)
- 1 yellow 1x3 Technic axle (x4)
- 1 orange 1x10 Technic beam (x2)
- 1 yellow 1x3 Technic axle (x2)
- 1 yellow 1x3 Technic axle (x2)
- 1 blue 1x3 Technic axle (x2)
- 1 blue 1x3 Technic axle (x2)
- 1 blue 1x3 Technic axle (x4)
- 1 grey motor (x1)
- 1 grey 1x3 Technic axle (x2)
- 1 yellow 1x3 Technic axle (x2)
- 1 black 1x3 Technic axle (x2)
- 1 grey 1x3 Technic axle (x4)
- 1 black 1x3 Technic axle (x10)
- 1 red 1x3 Technic axle (x2)
- 1 grey 1x3 Technic axle (x5)
- 1 black 1x3 Technic axle (x4)
- 1 grey 1x3 Technic axle (x4)
- 1 black 1x10 Technic beam (x2)

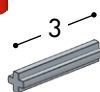
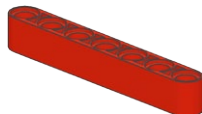




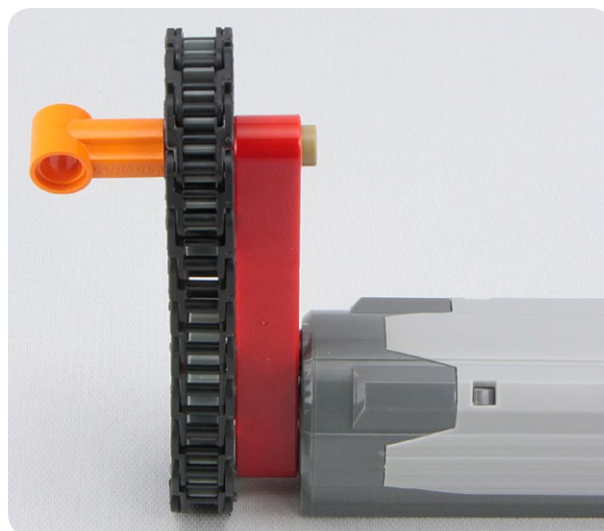


Transmitting rotation with chains and treads

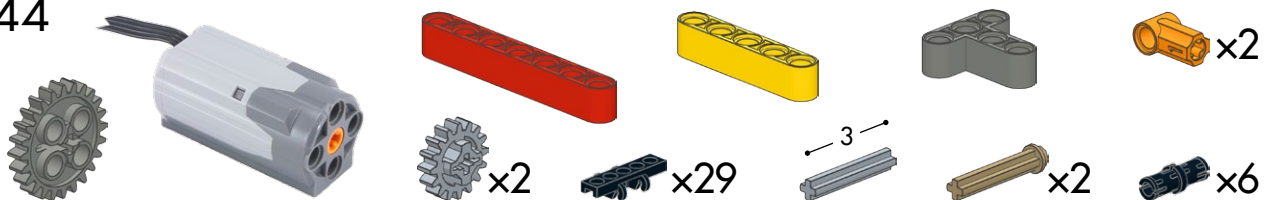
#143



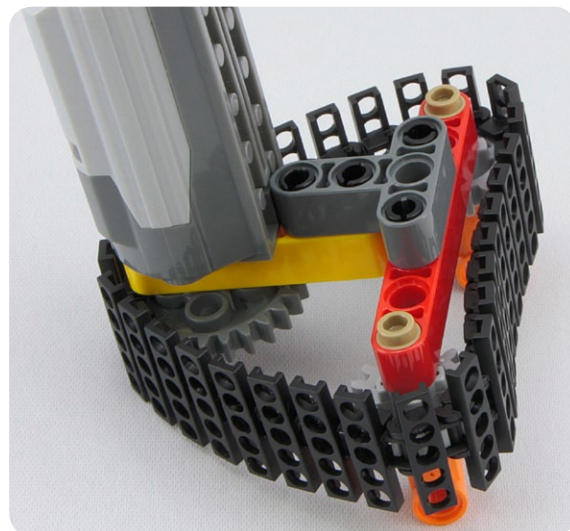
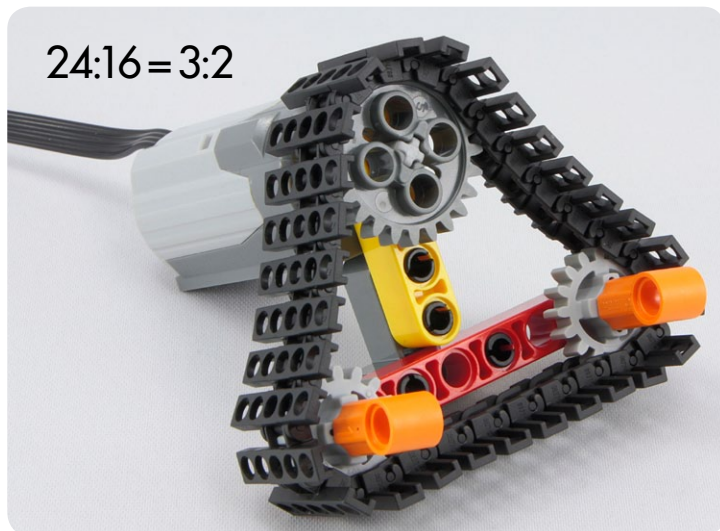
$24:24 = 1:1$



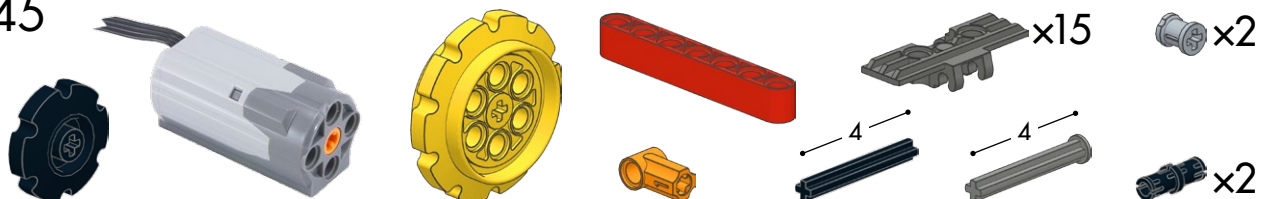
#144



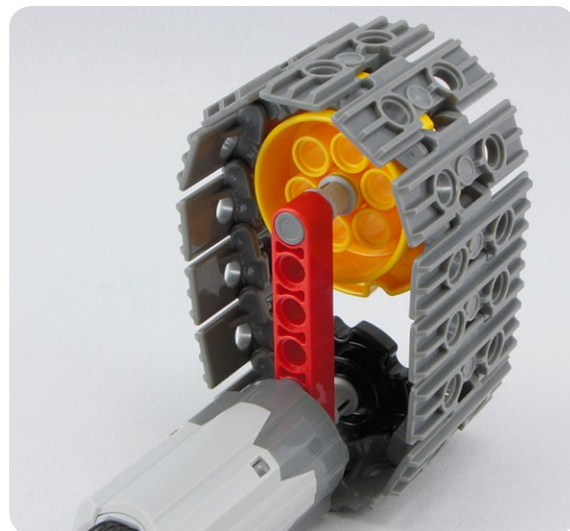
$24:16 = 3:2$



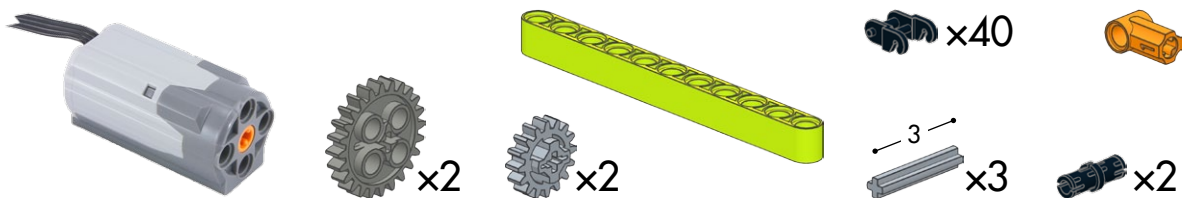
#145



$6:10 = 3:5$



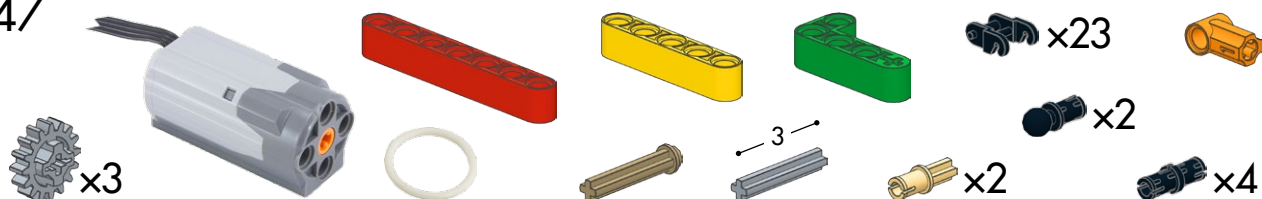
#146



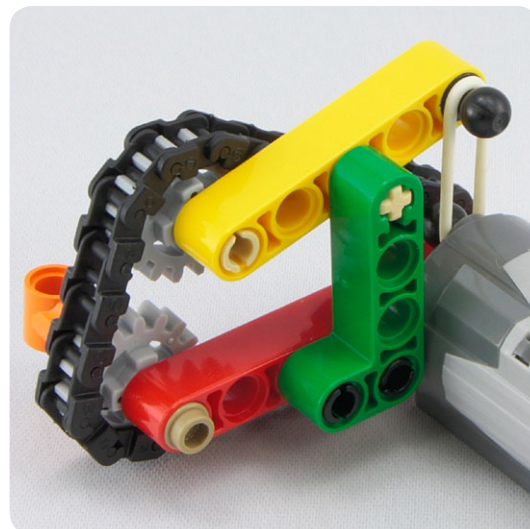
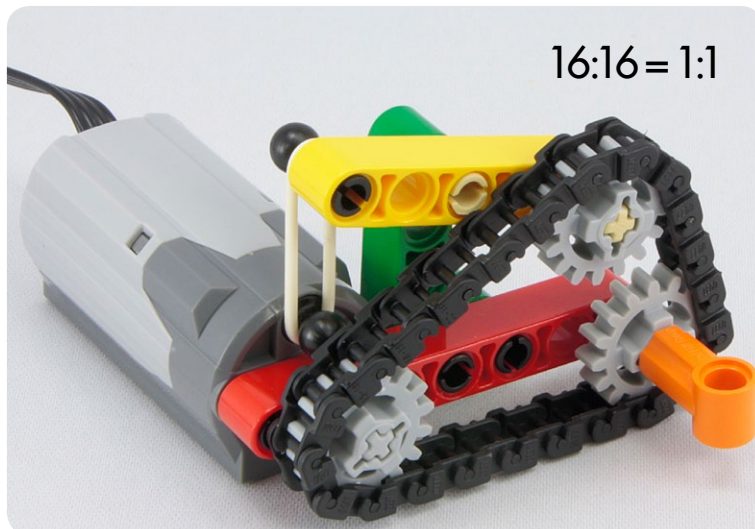
16:24 = 4:6
16:24 = 6:9



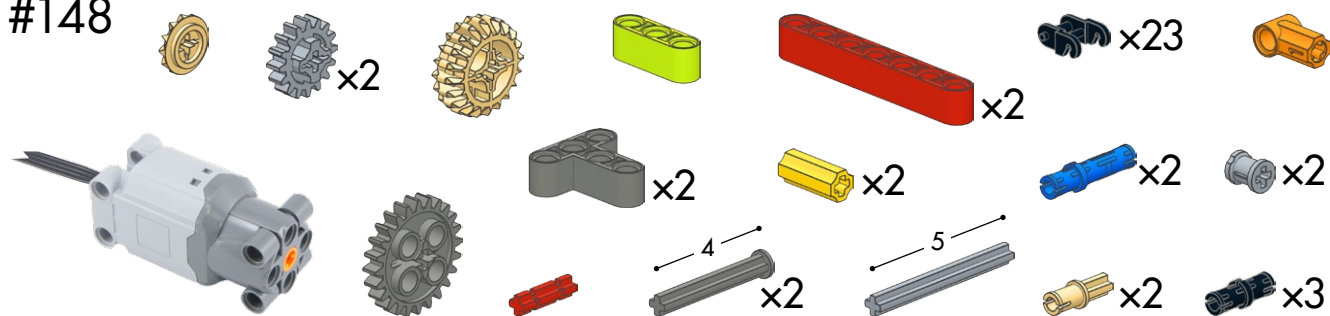
#147



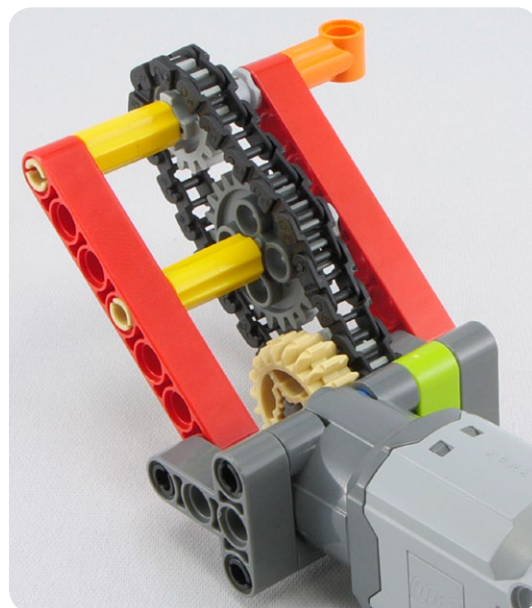
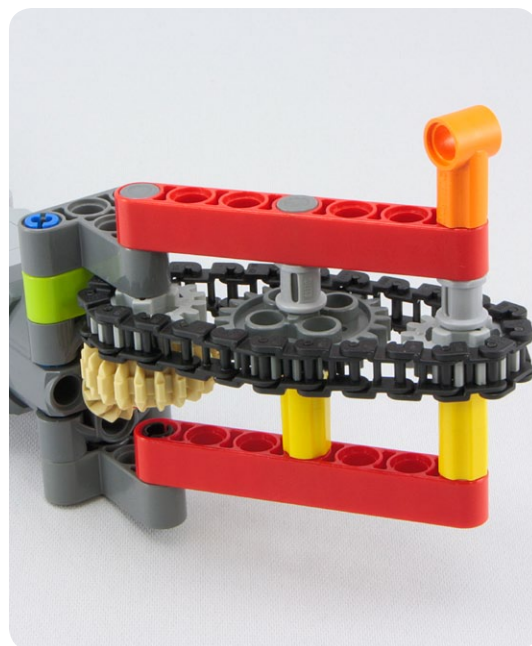
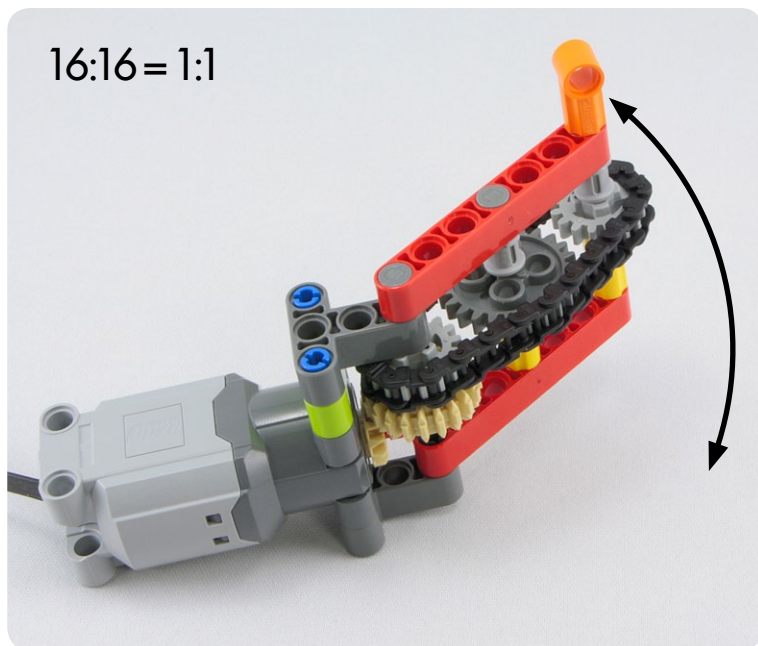
16:16 = 1:1

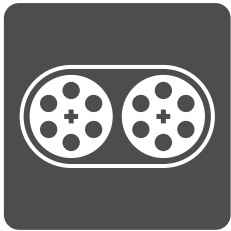


#148



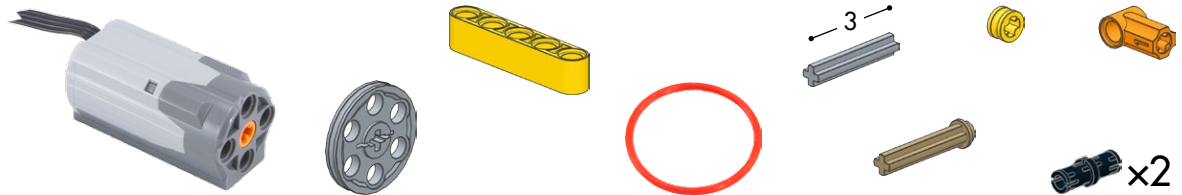
16:16 = 1:1



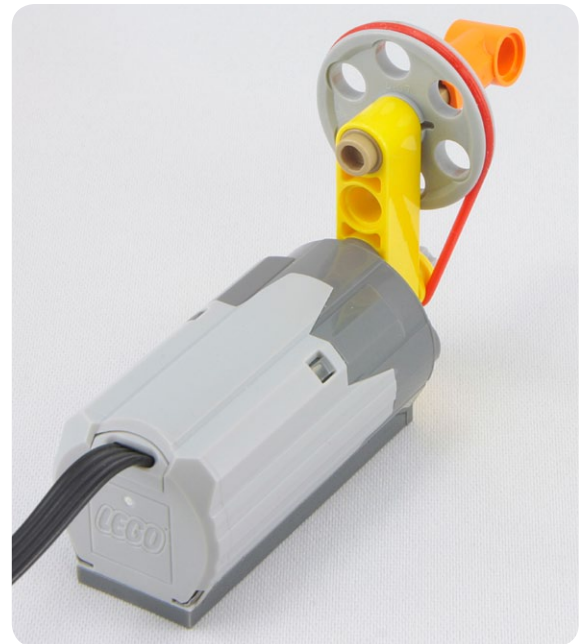
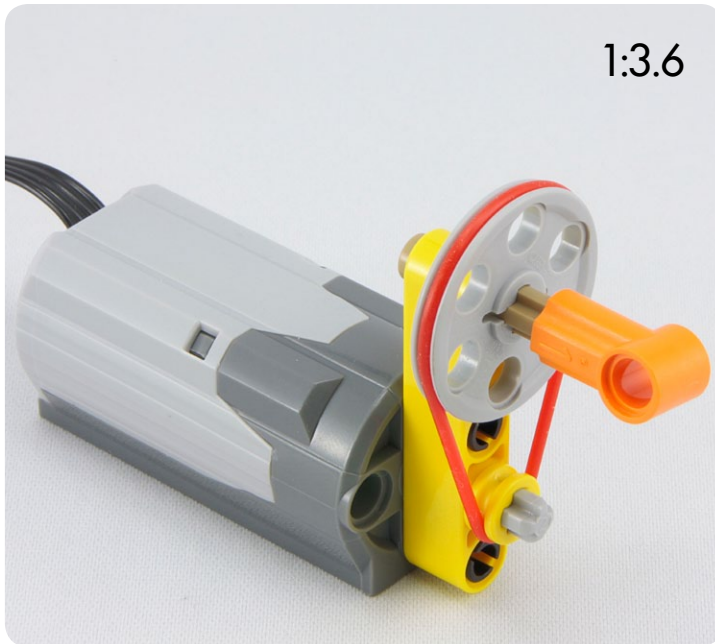


Transmitting rotation with rubber bands

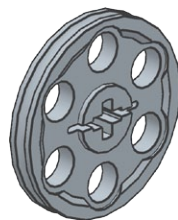
#149



1:3.6



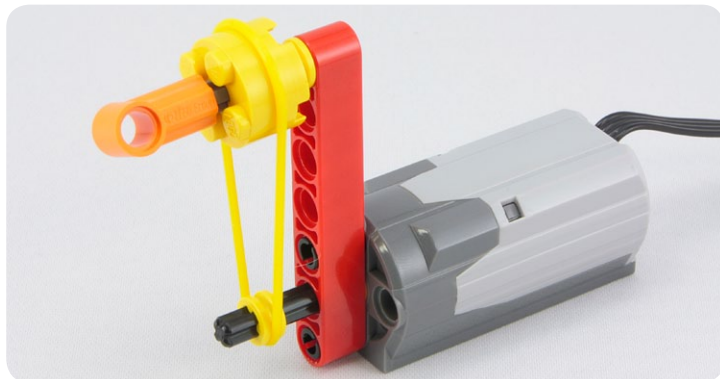
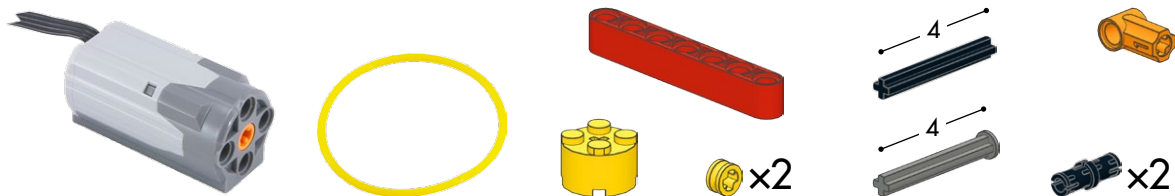
 6.2 mm



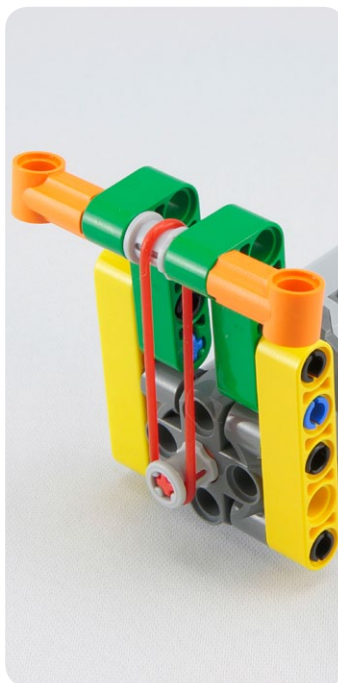
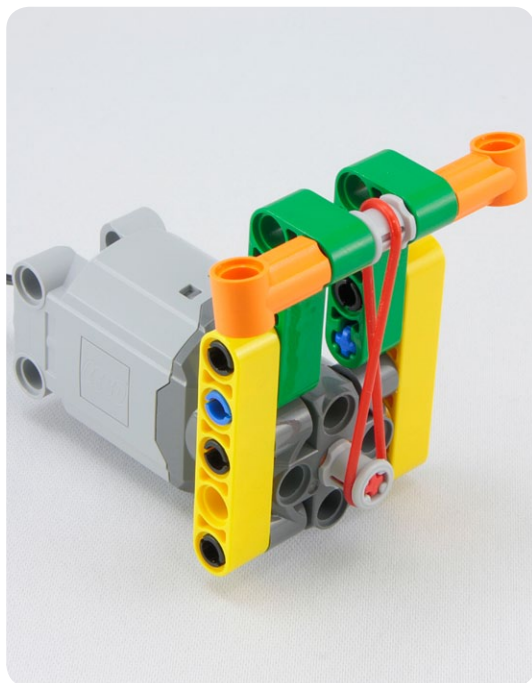
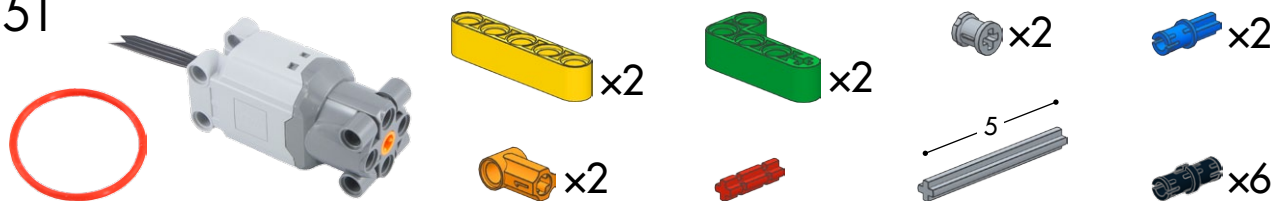
22.3 mm

$6.2:22.3 \approx 1:3.6$

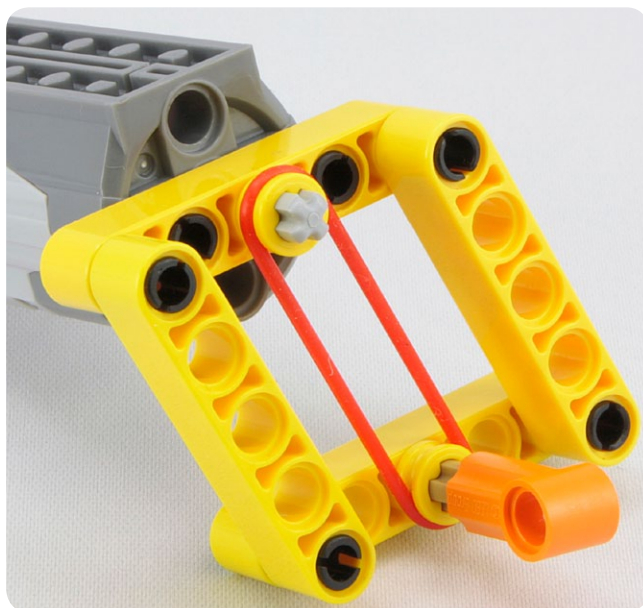
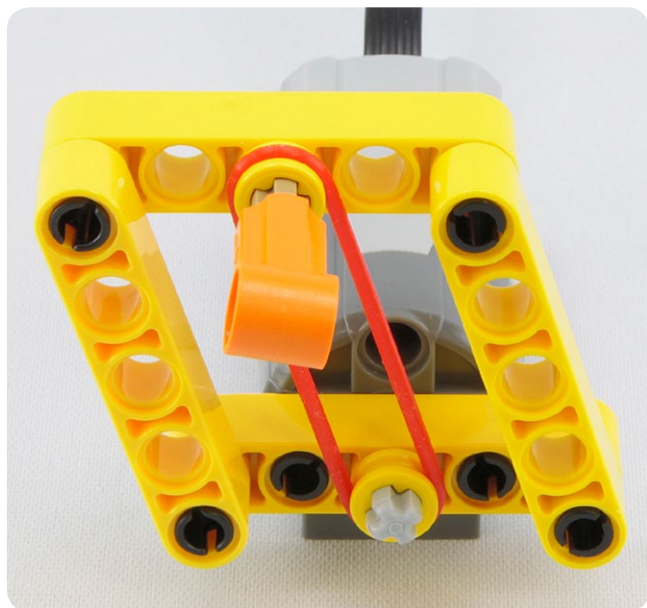
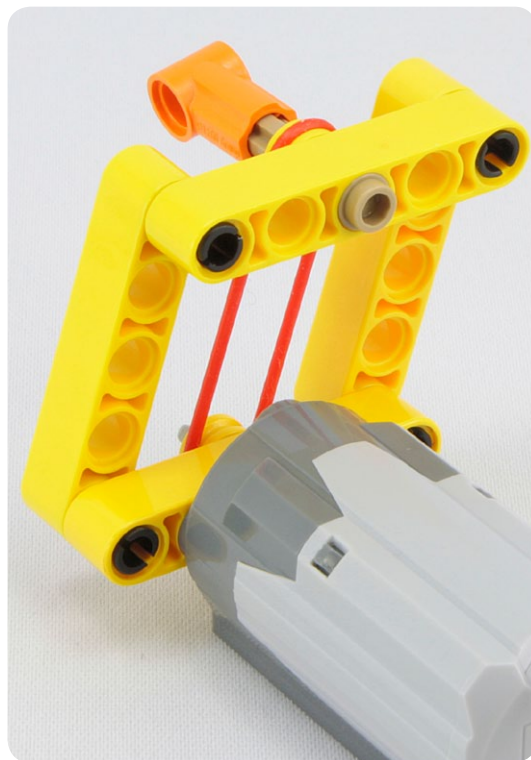
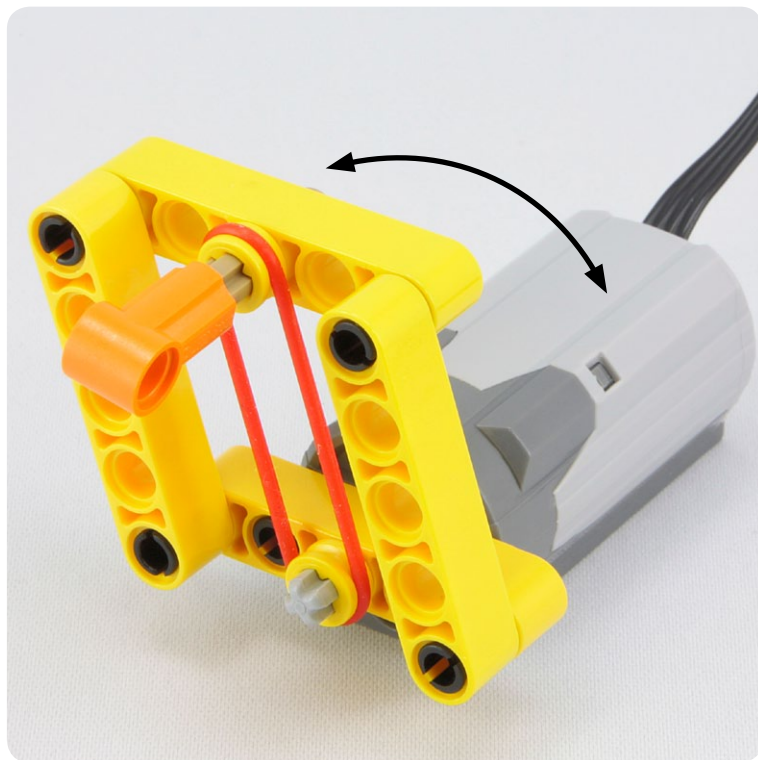
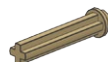
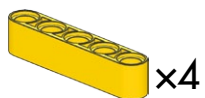
#150



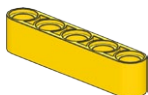
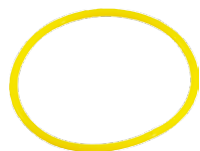
#151



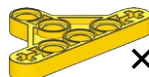
#152



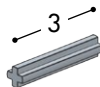
#153



x2



x2



x3



x3



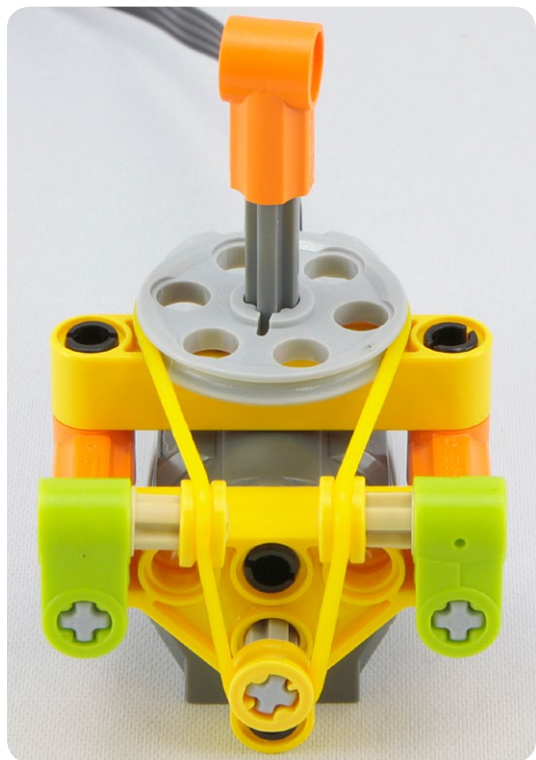
x3

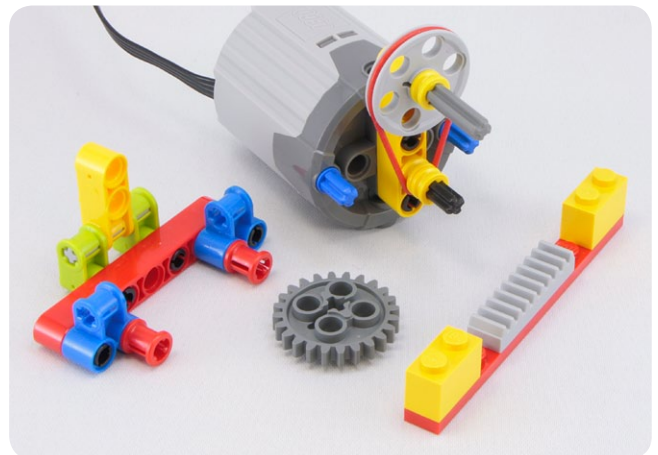
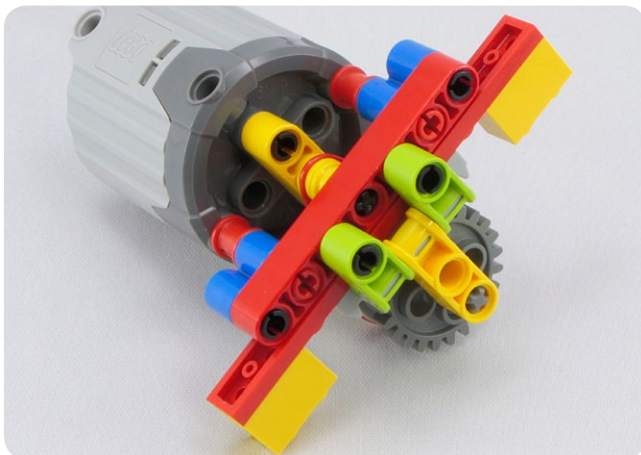
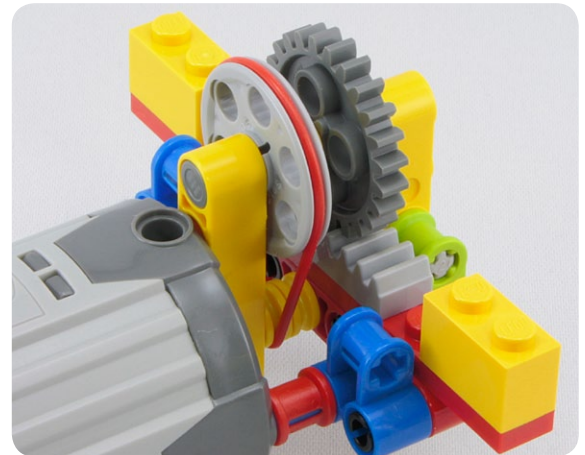
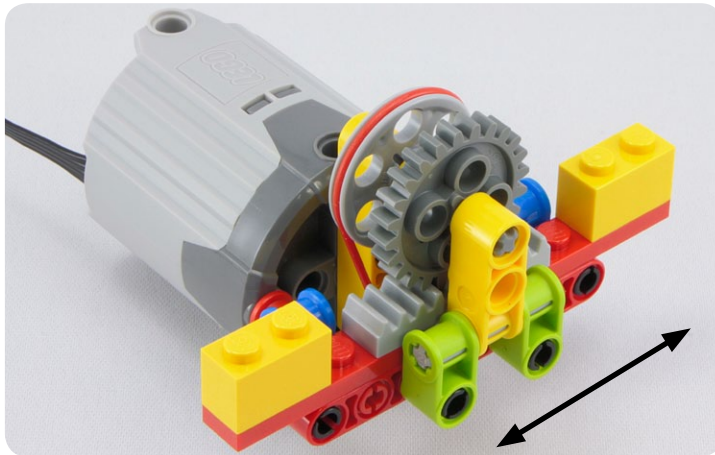


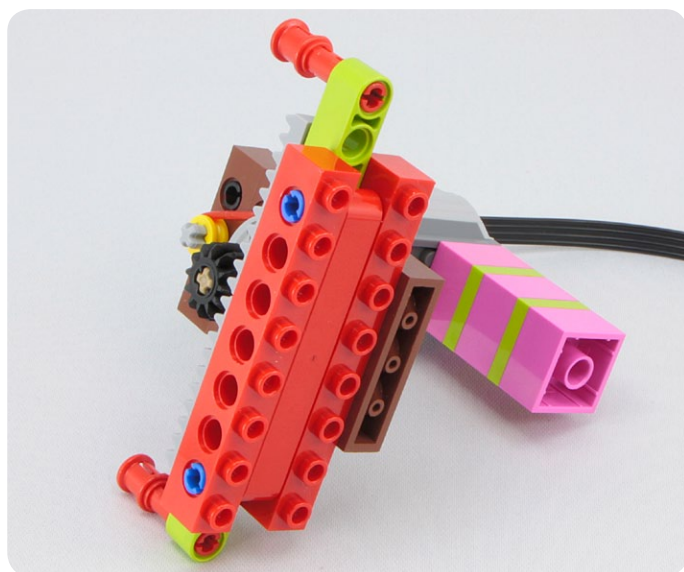
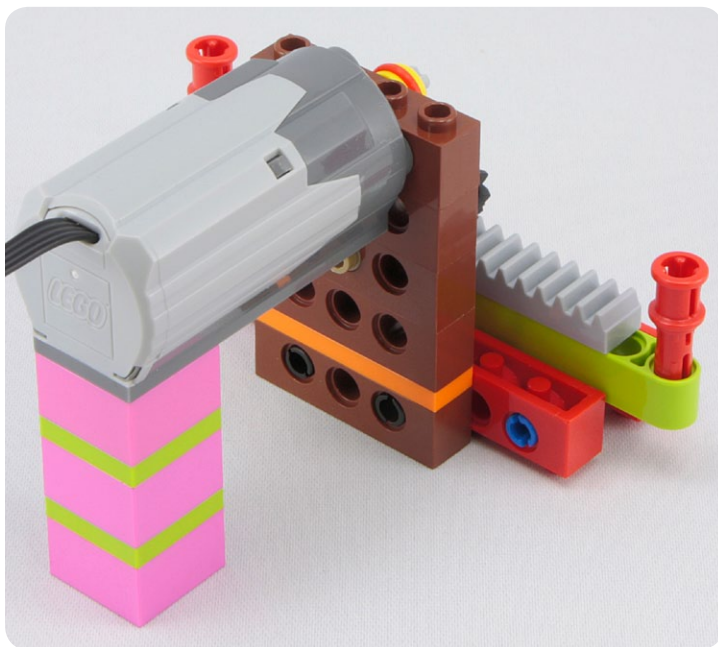
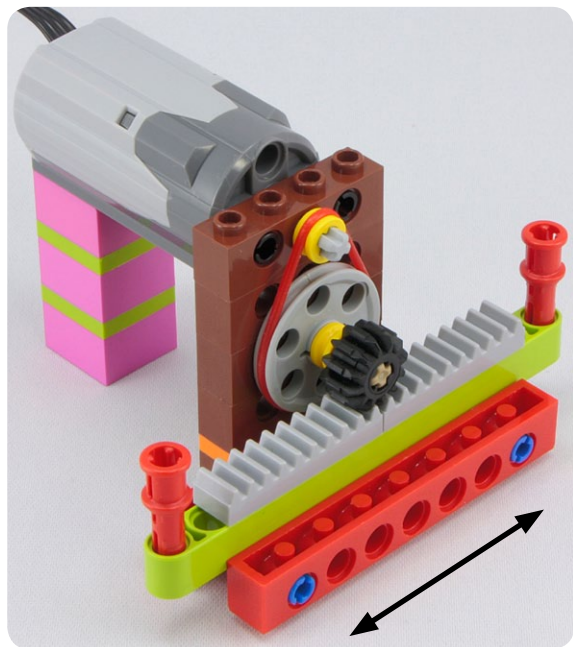
x2



x4

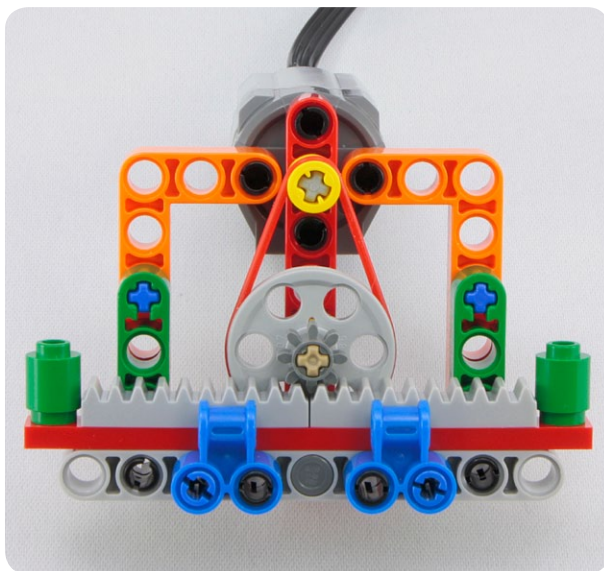
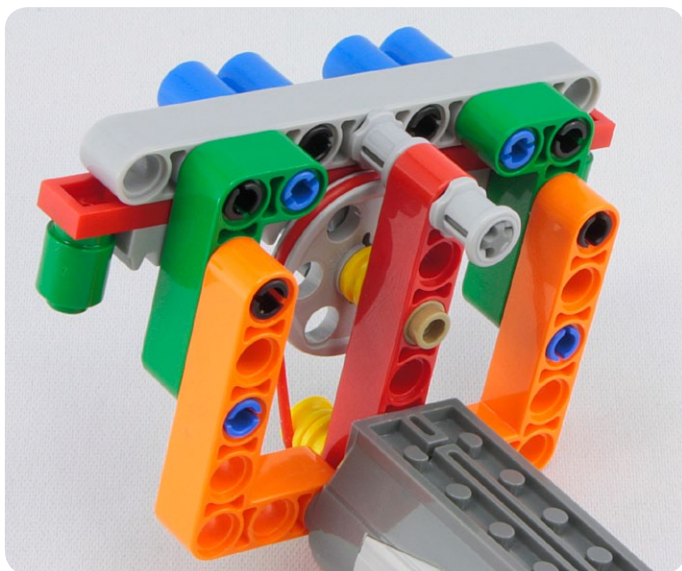
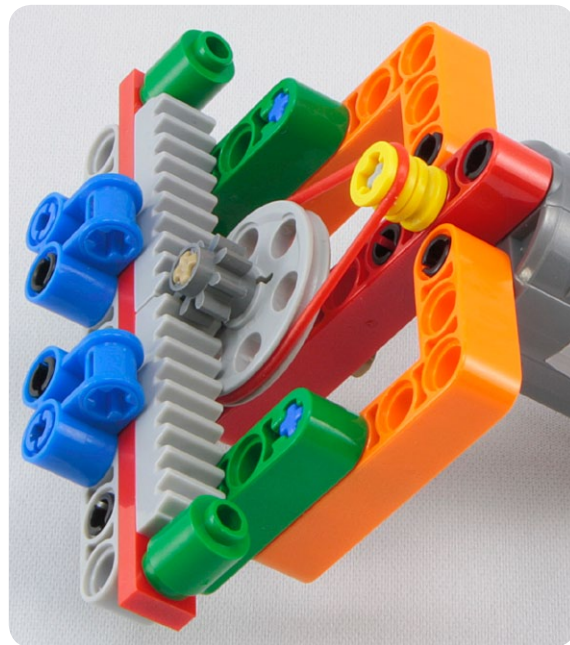
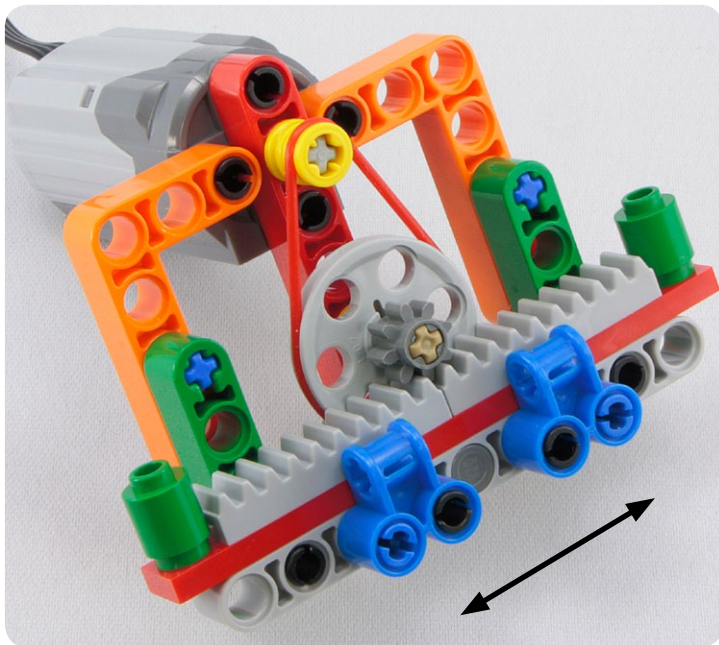




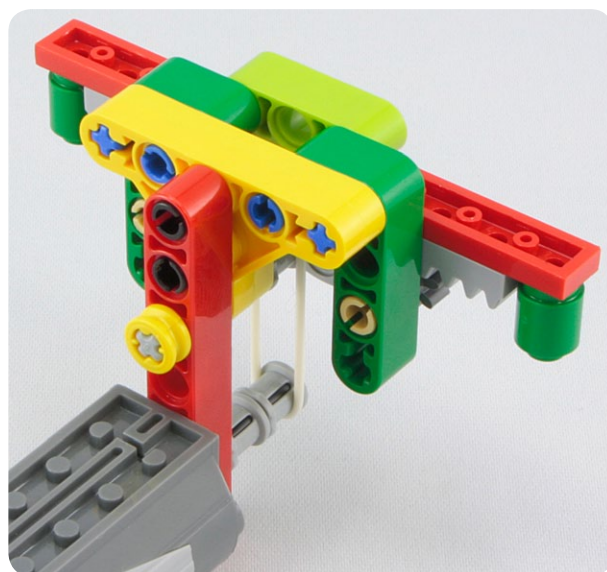
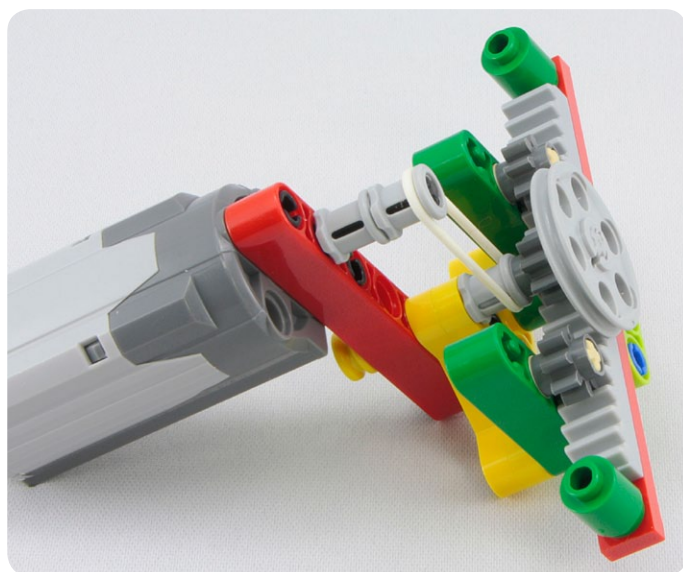
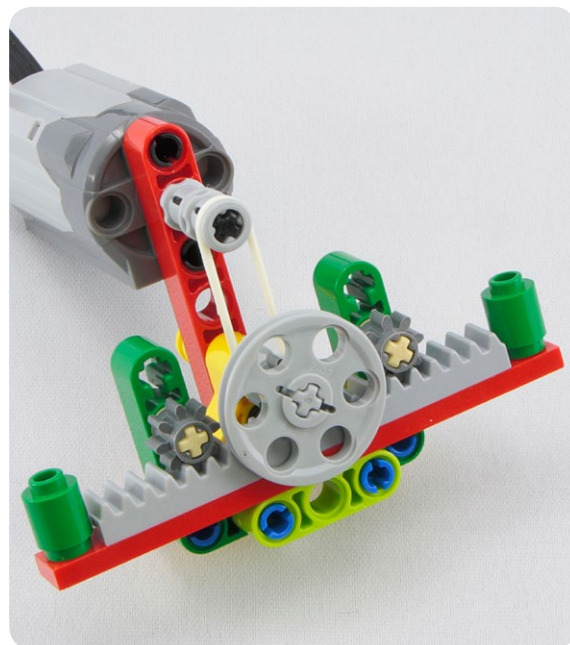
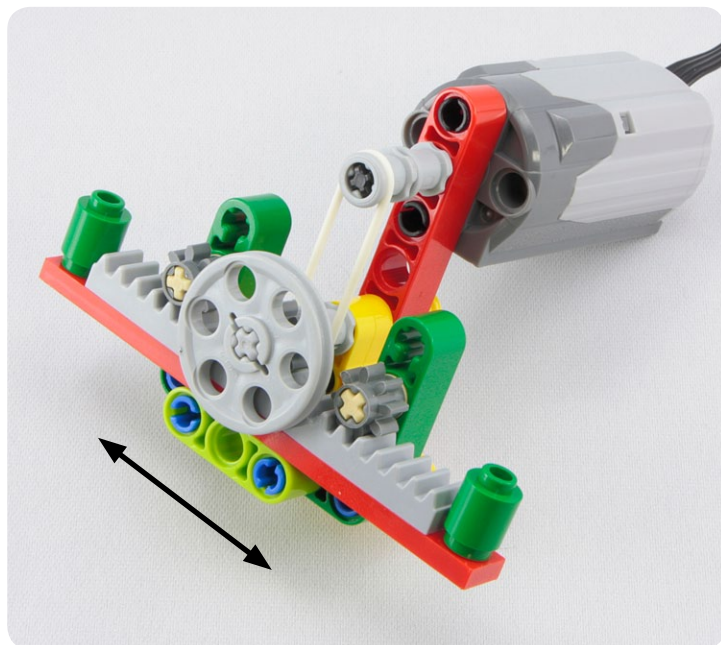
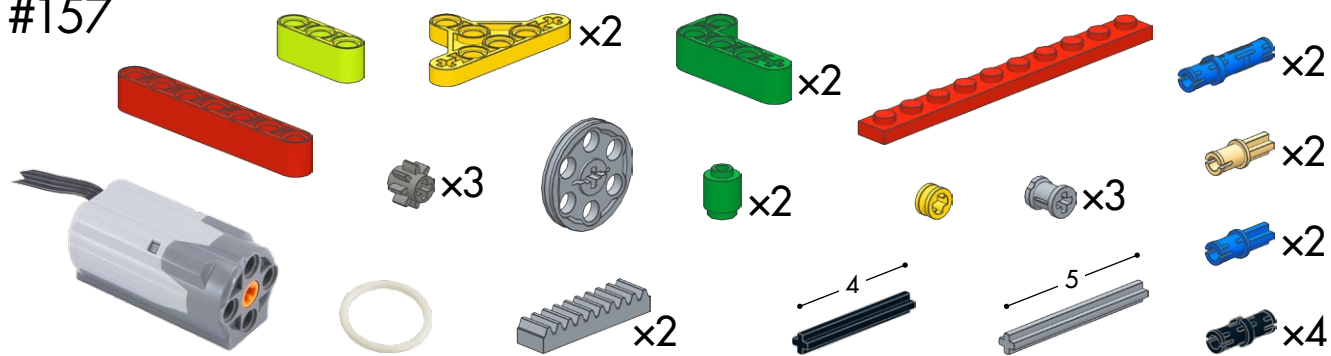
[illegible]

#156

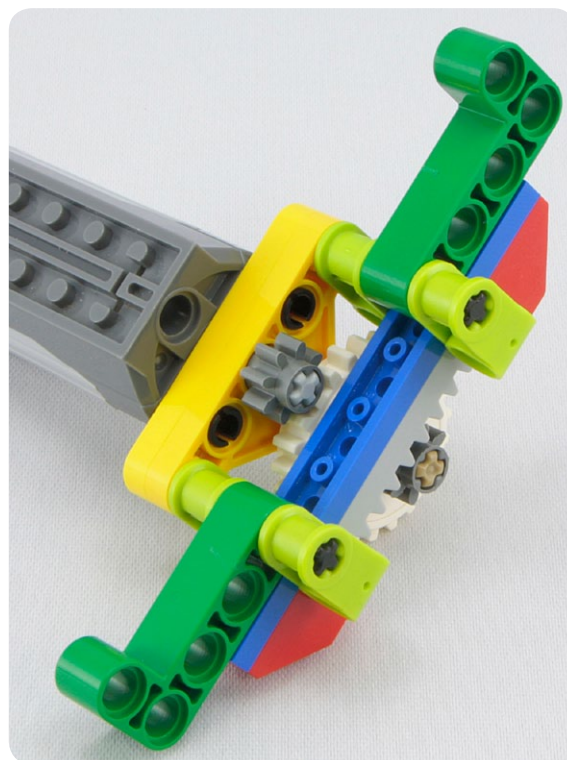
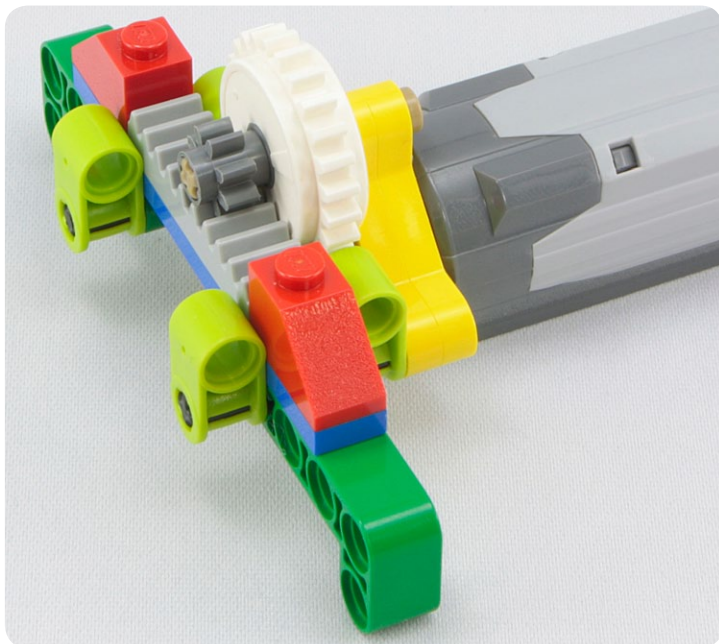
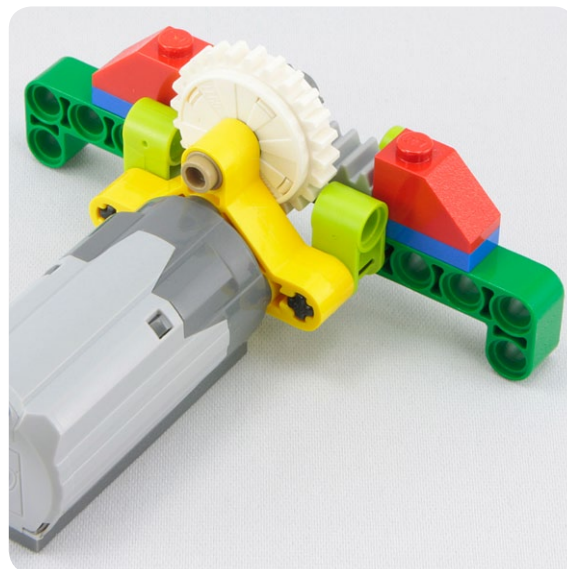
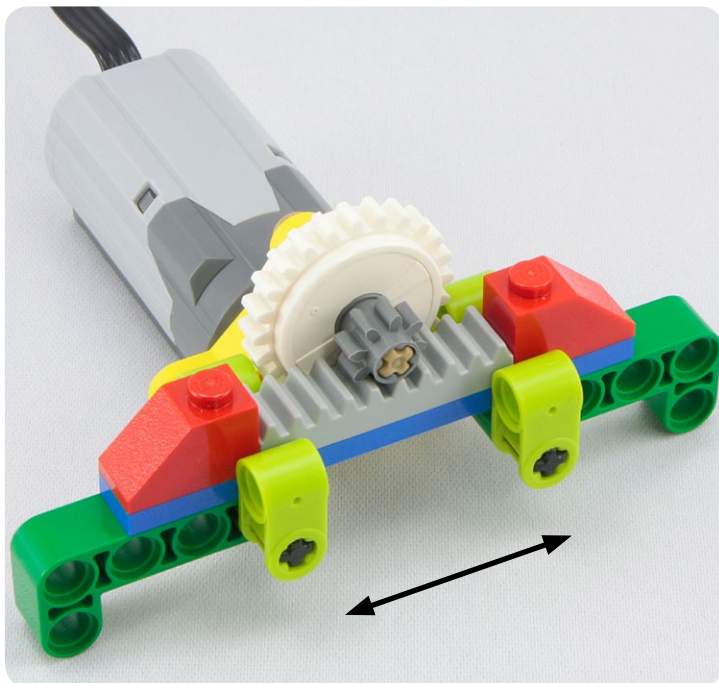
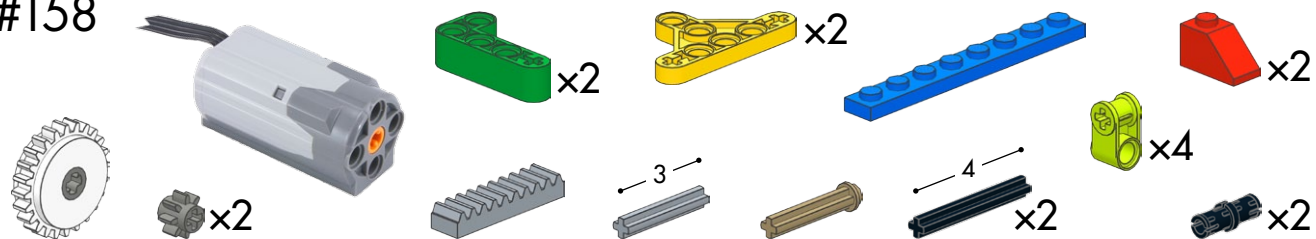
1 red 1x6 Technic beam
1 grey 1x10 Technic beam
1 orange 1x3 Technic beam
2 orange 1x3 Technic beams
2 green 1x3 Technic beams
1 red 1x10 Technic beam
3 yellow 1x1 Technic pins
1 grey motor
1 grey 1x1 Technic connector
1 grey 1x1 Technic wheel
2 blue 1x3 Technic connectors
2 green 1x1 Technic pins
2 grey 1x1 Technic pins
2 blue 1x3 Technic connectors
2 blue 1x3 Technic connectors
2 grey 1x1 Technic pins
1 red 1x1 Technic ring
2 grey 1x3 Technic beams
3 grey 1x3 Technic beams
1 tan 1x3 Technic beam
4 grey 1x3 Technic beams
2 blue 1x3 Technic connectors
2 blue 1x3 Technic connectors
2 grey 1x1 Technic pins
10 black 1x1 Technic pins



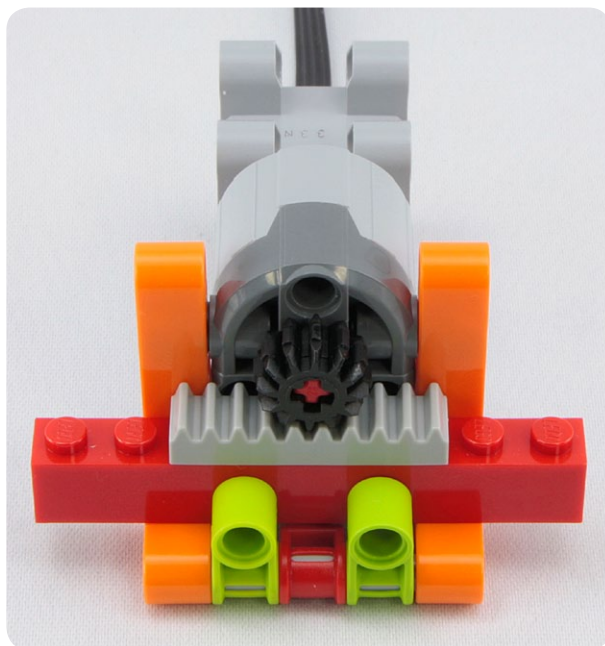
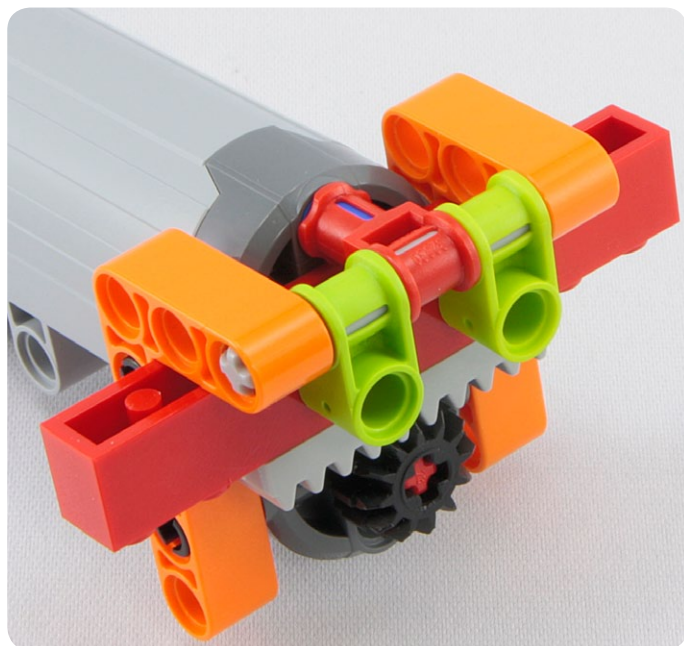
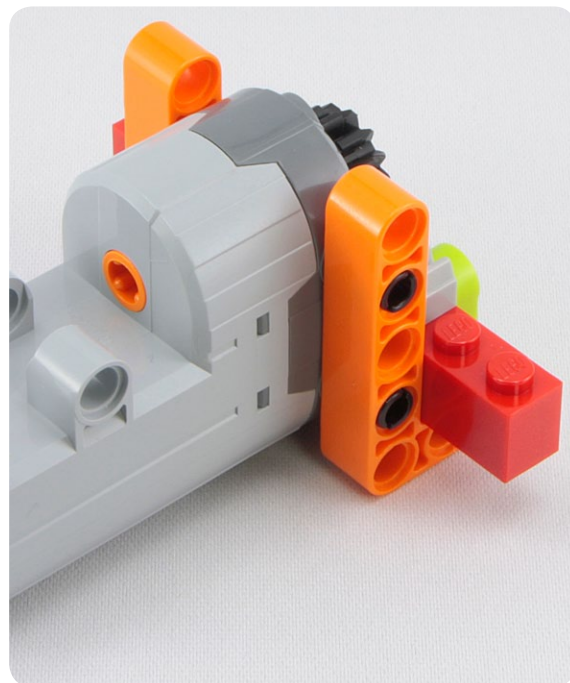
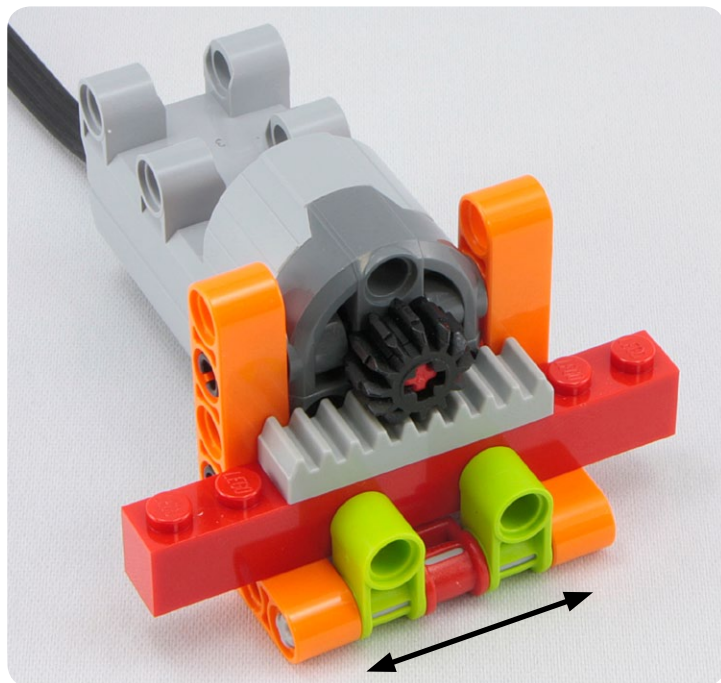
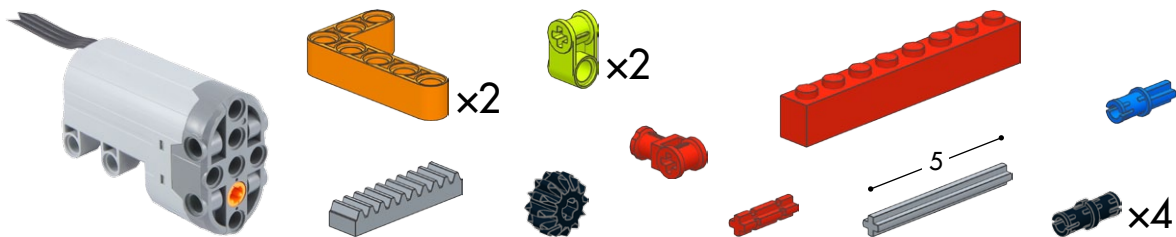
#157

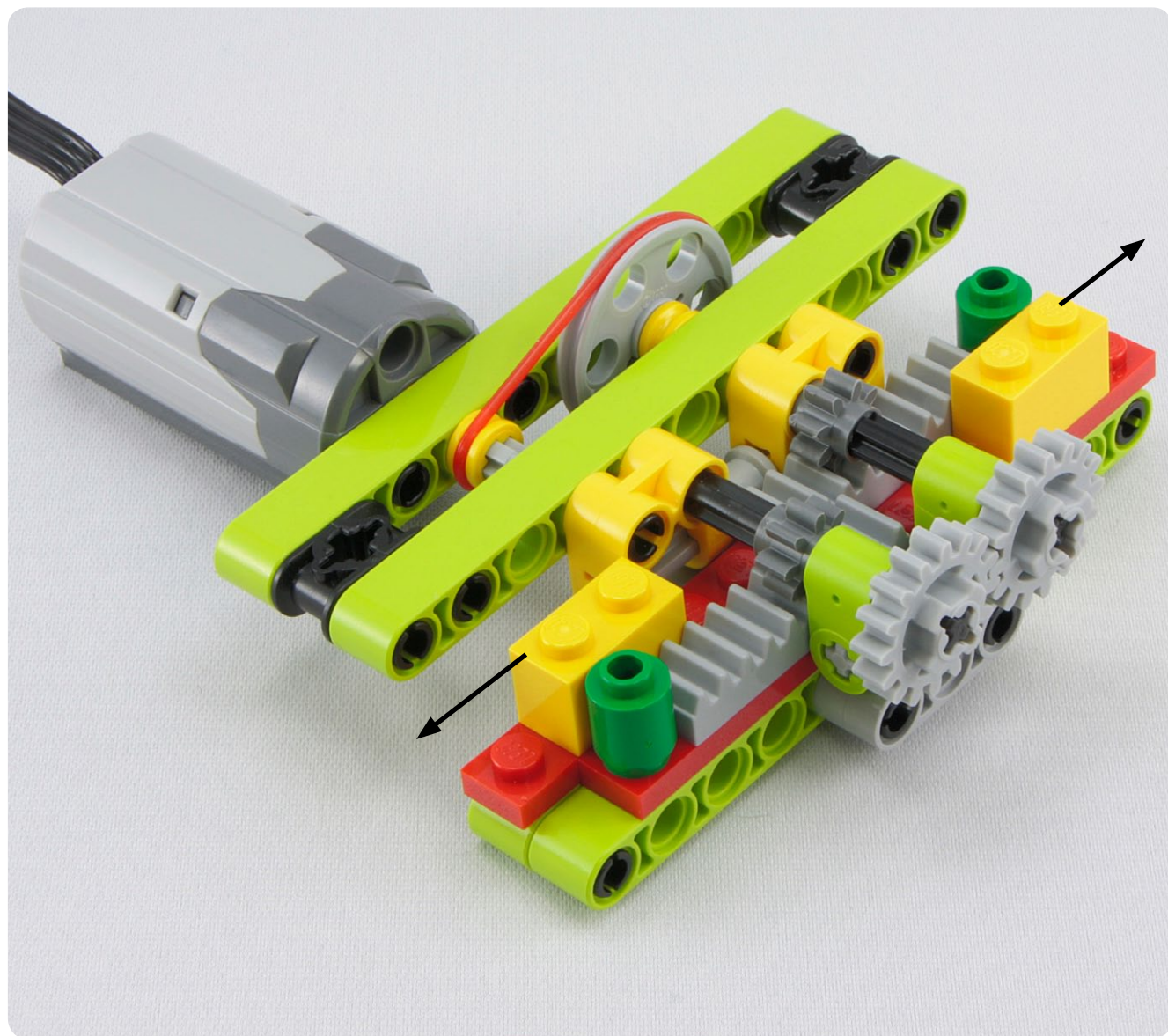


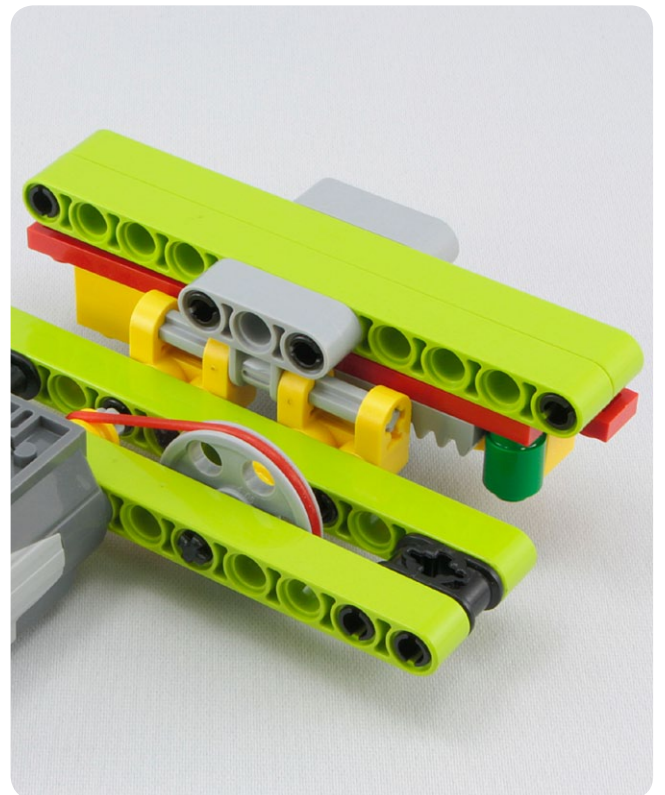
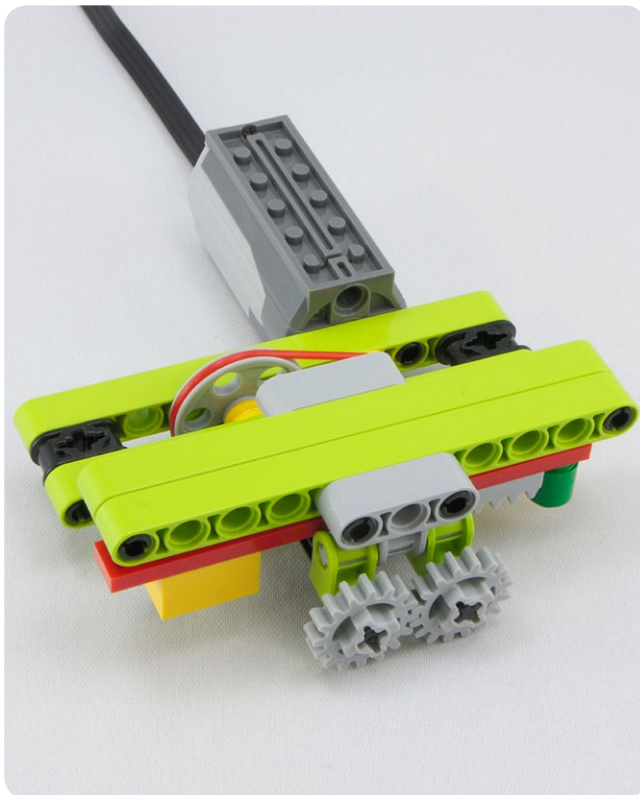
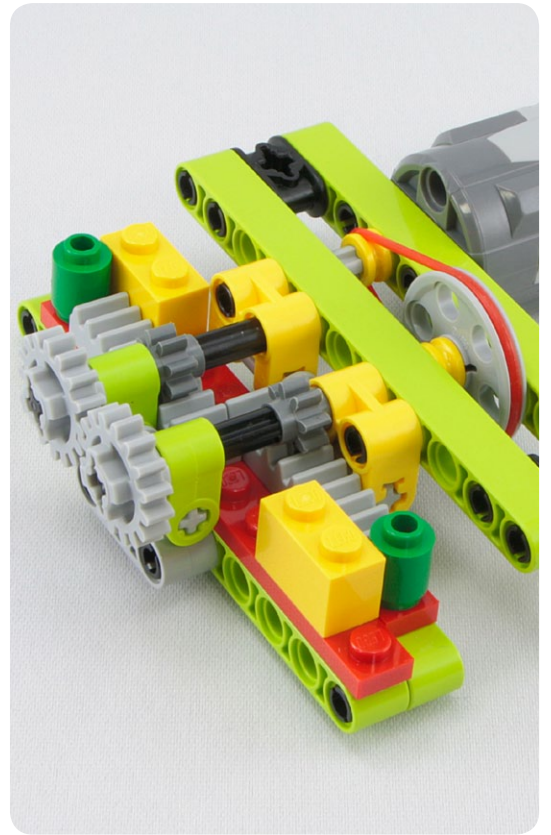
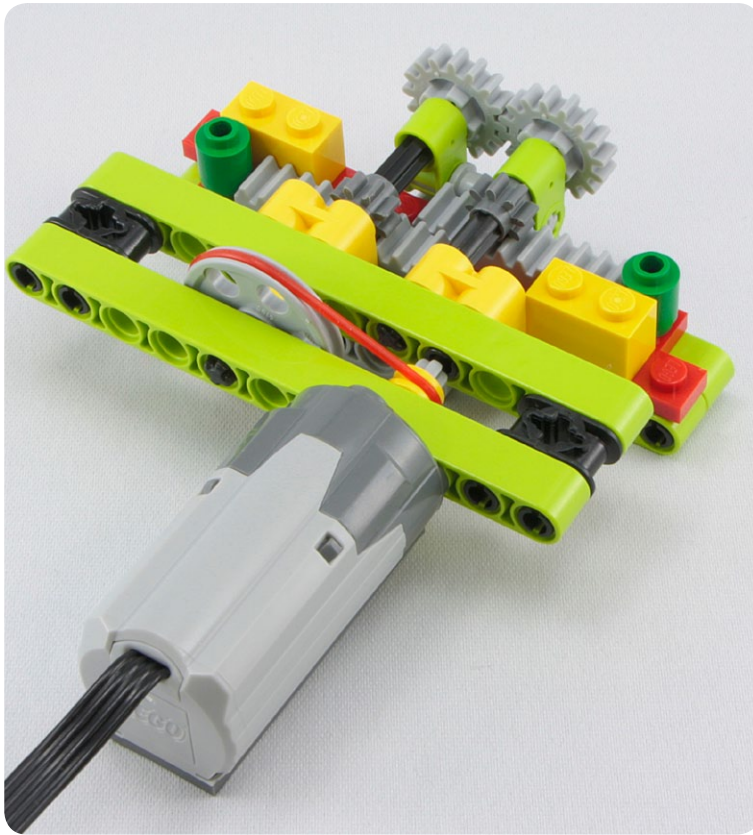
#158



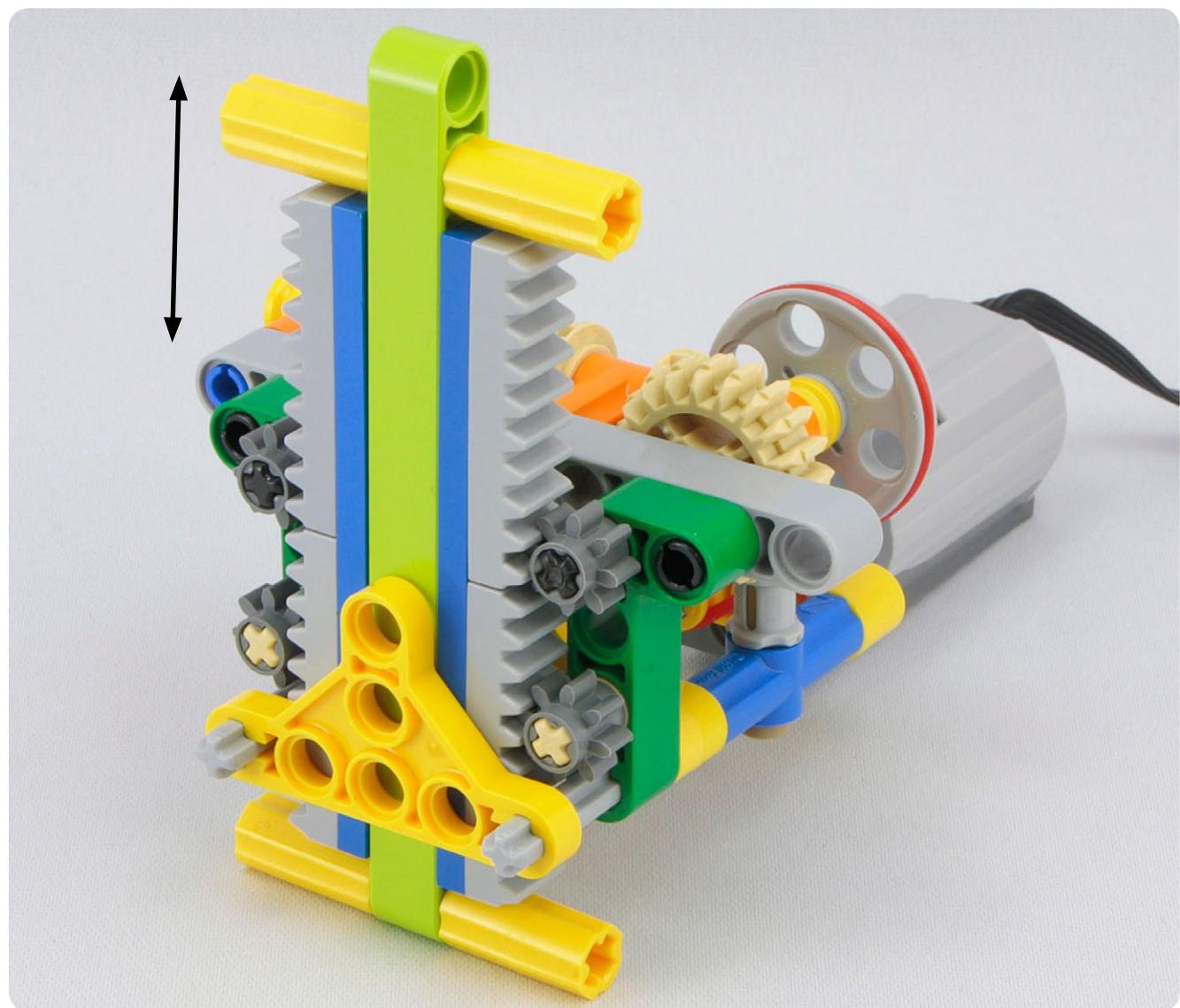
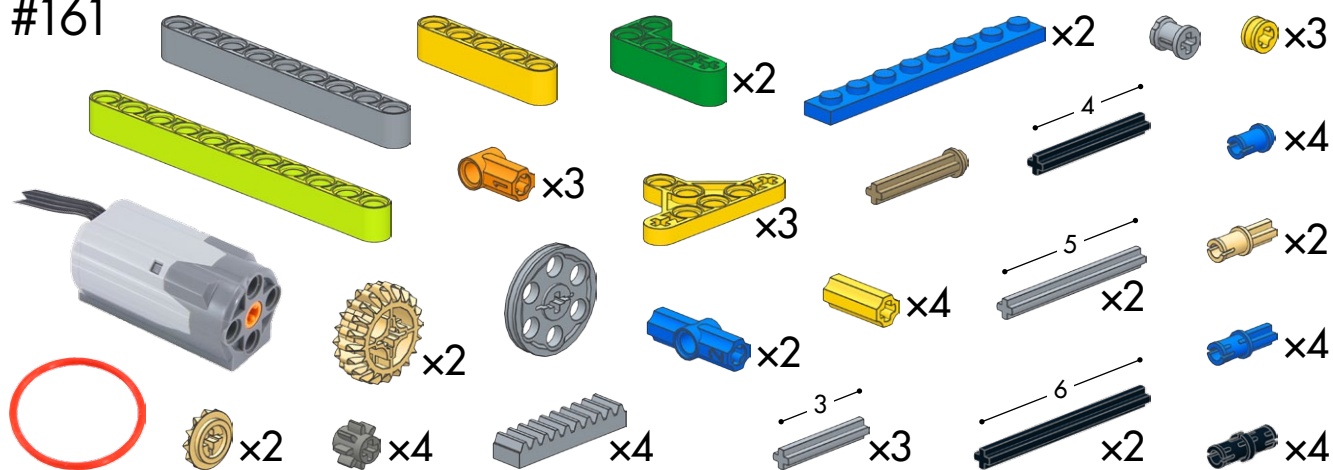
#159

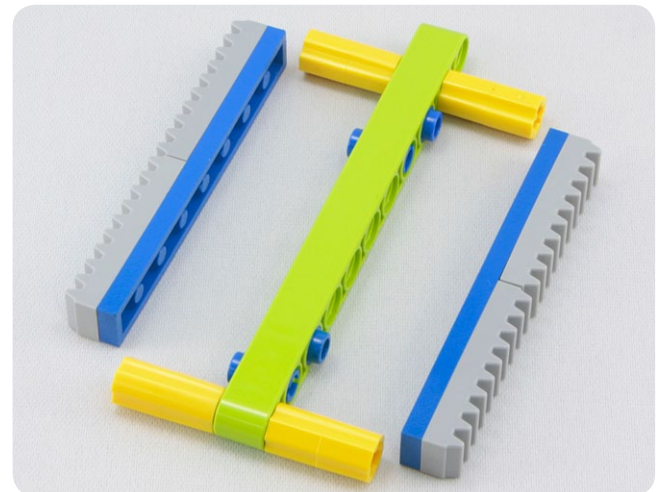
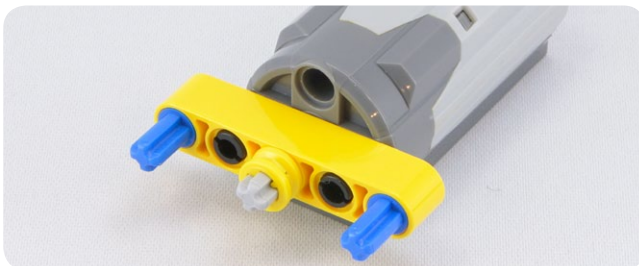
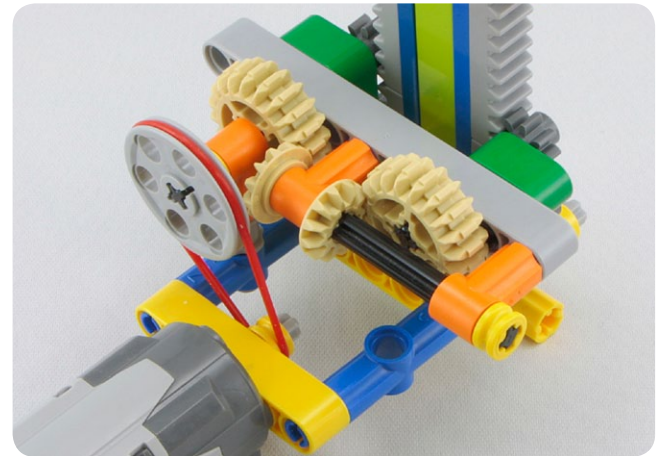
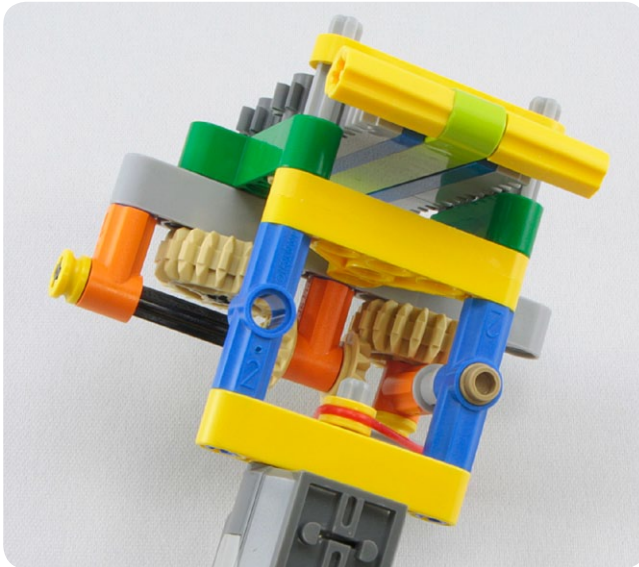
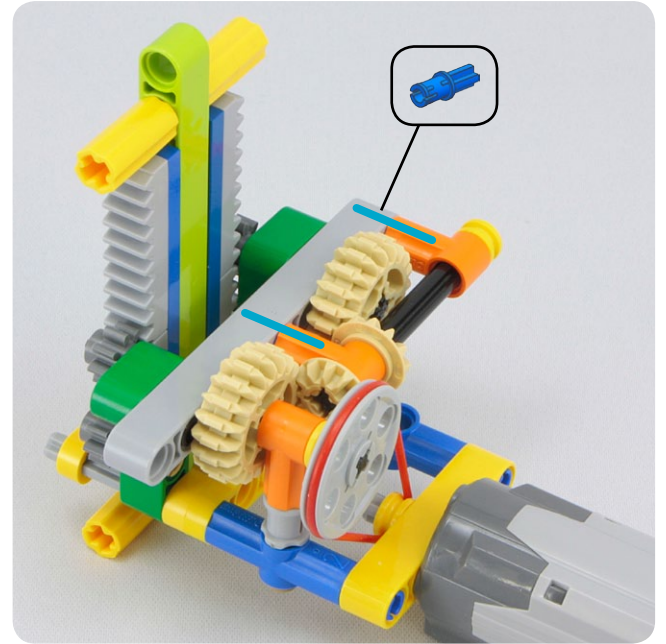


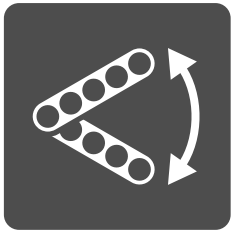
[illegible]



#161

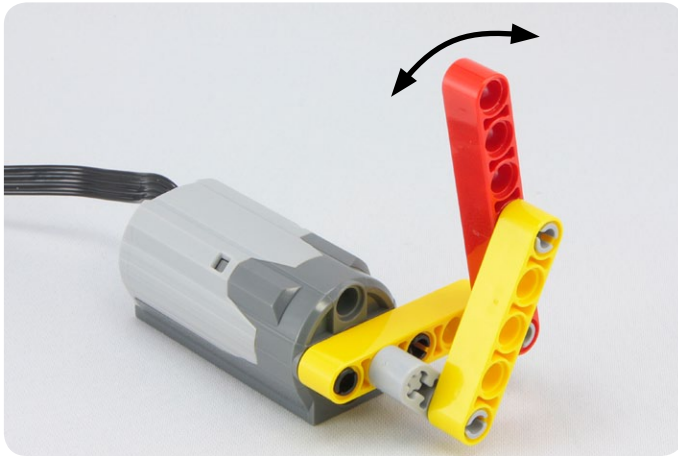
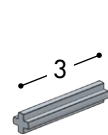
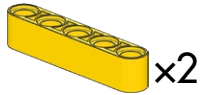




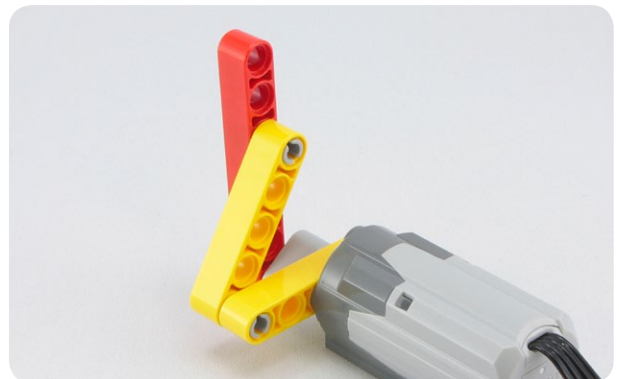
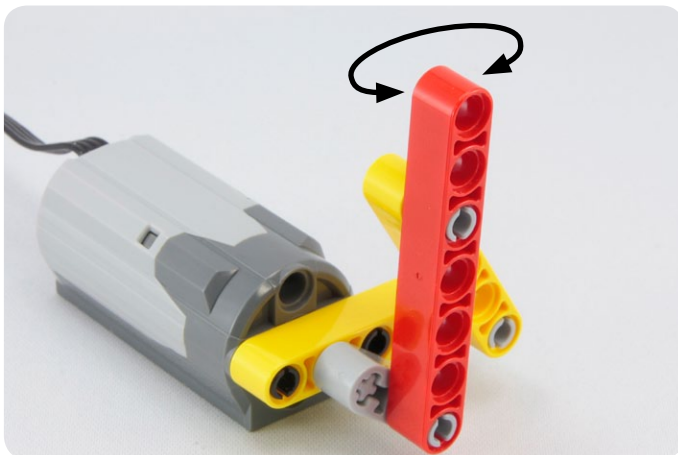
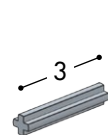
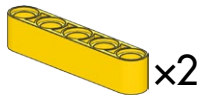


Swinging mechanisms

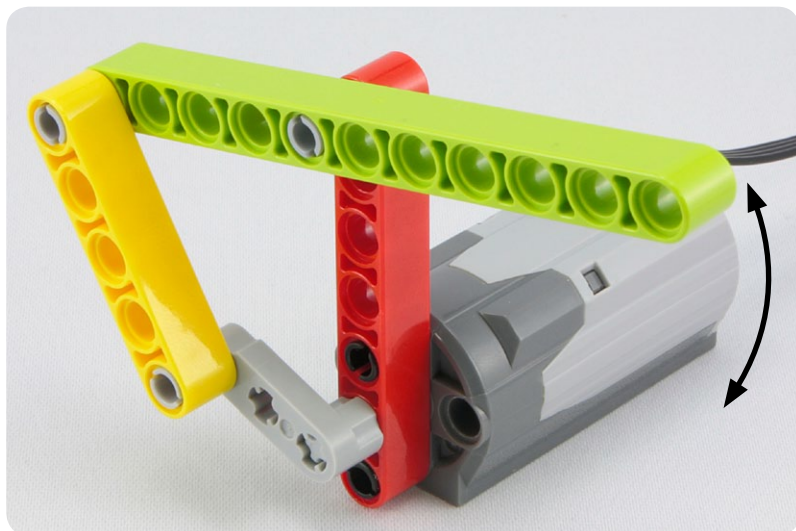
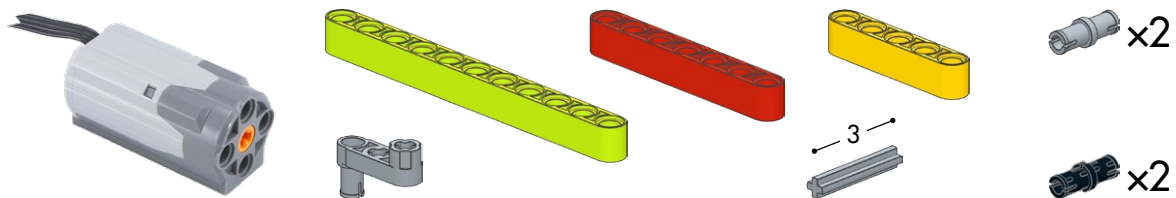
#162



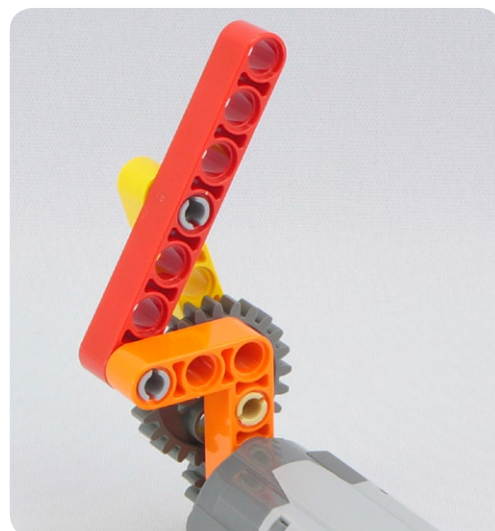
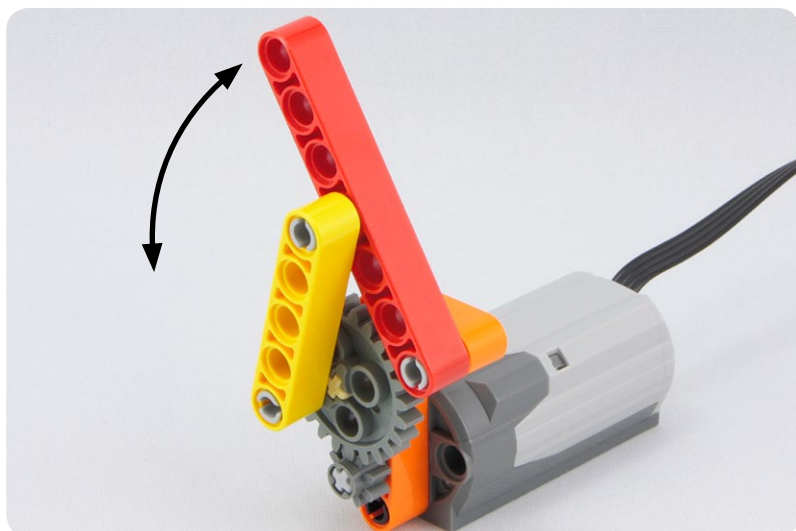
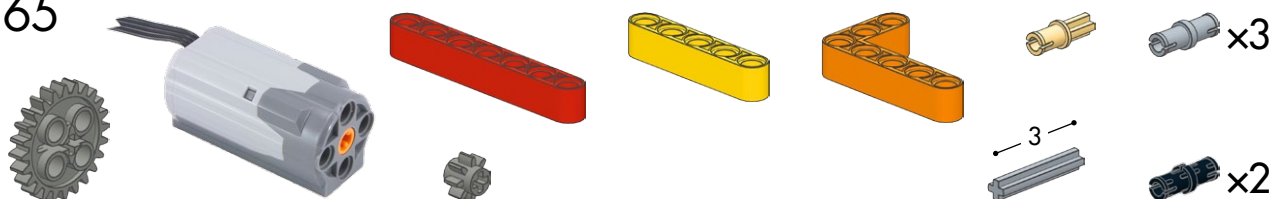
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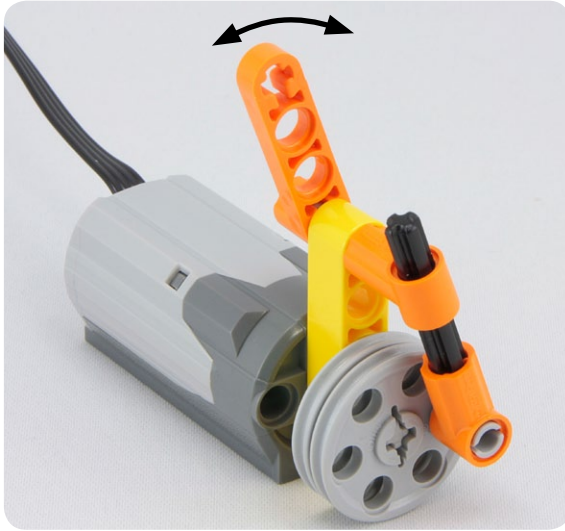
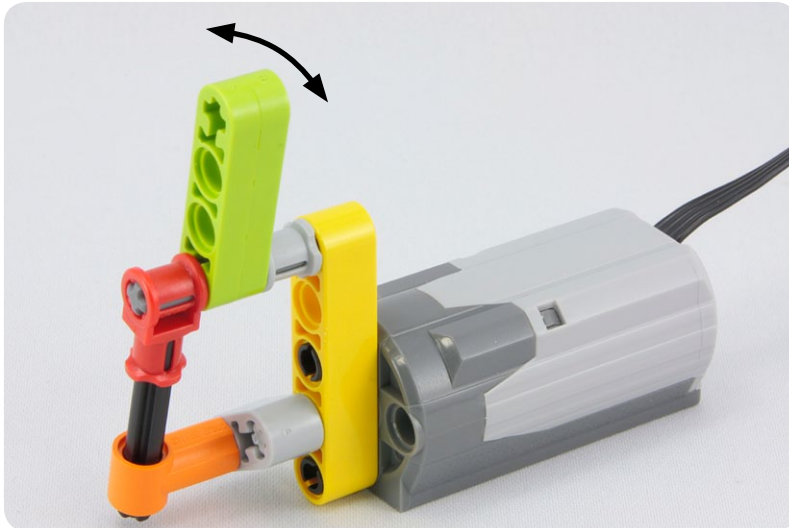


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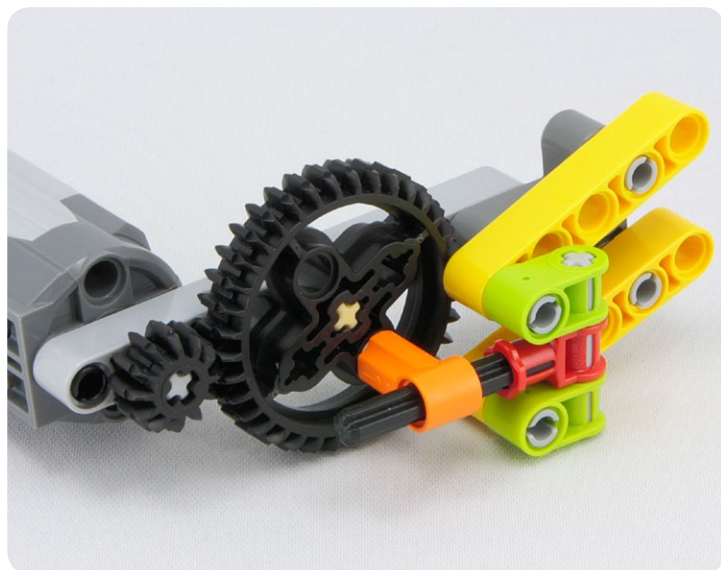
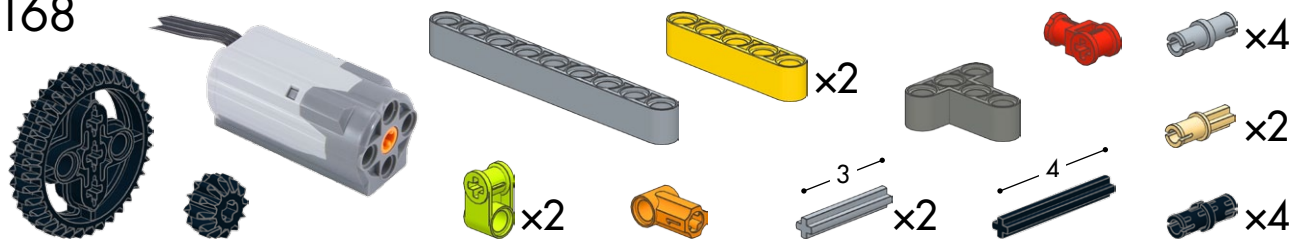


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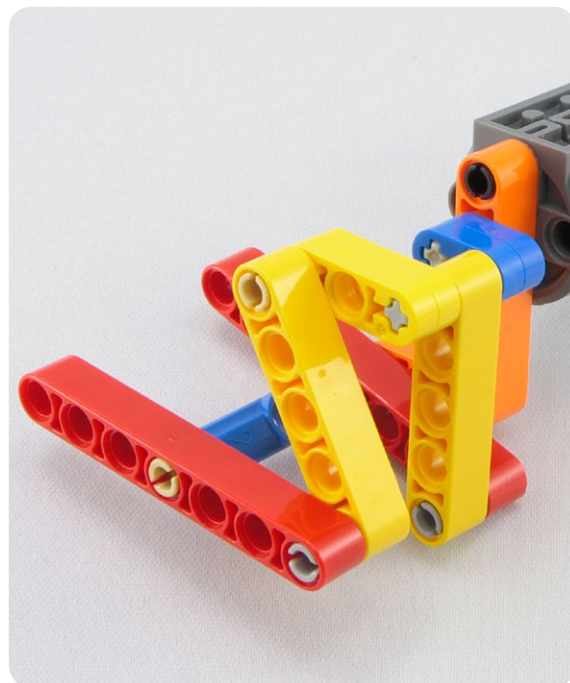
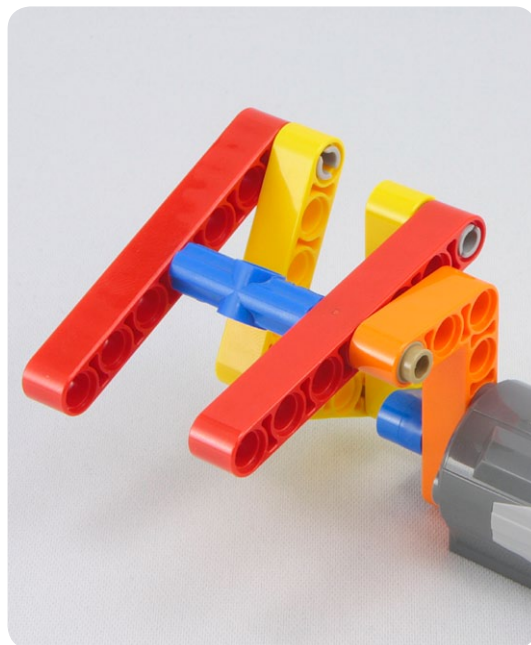
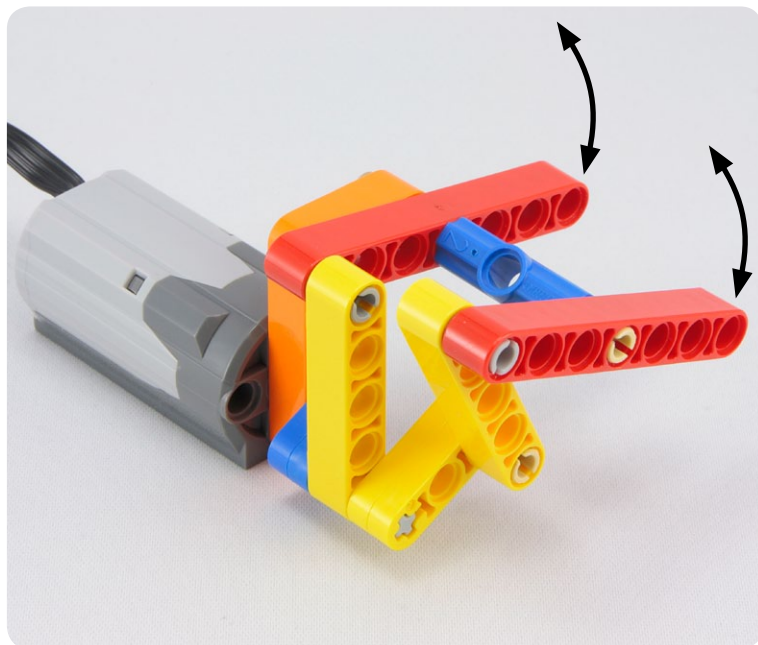
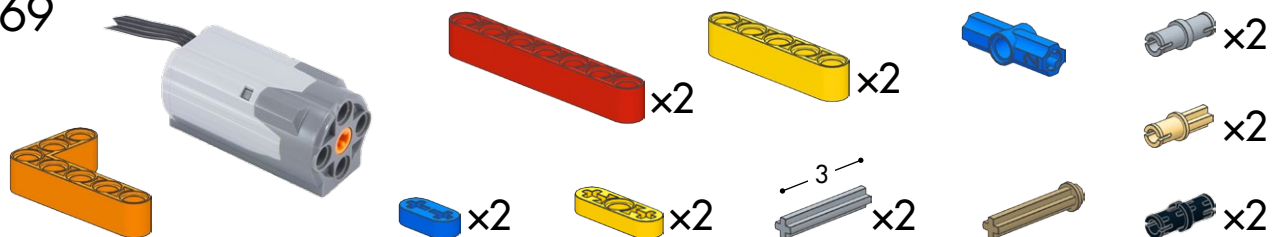


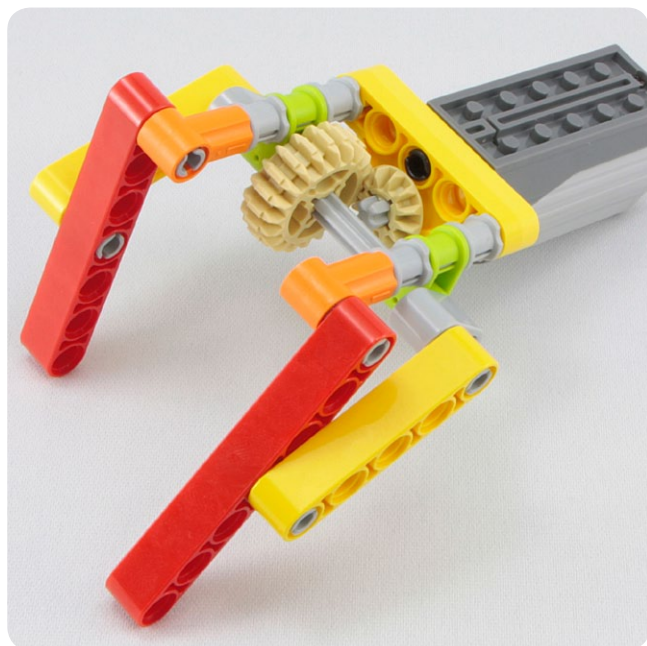
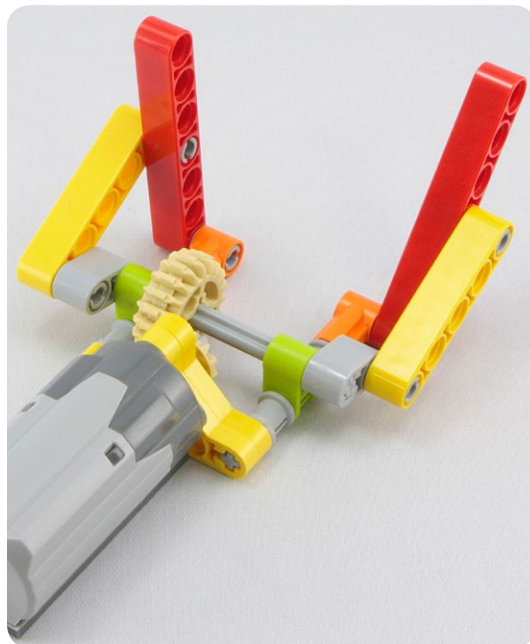
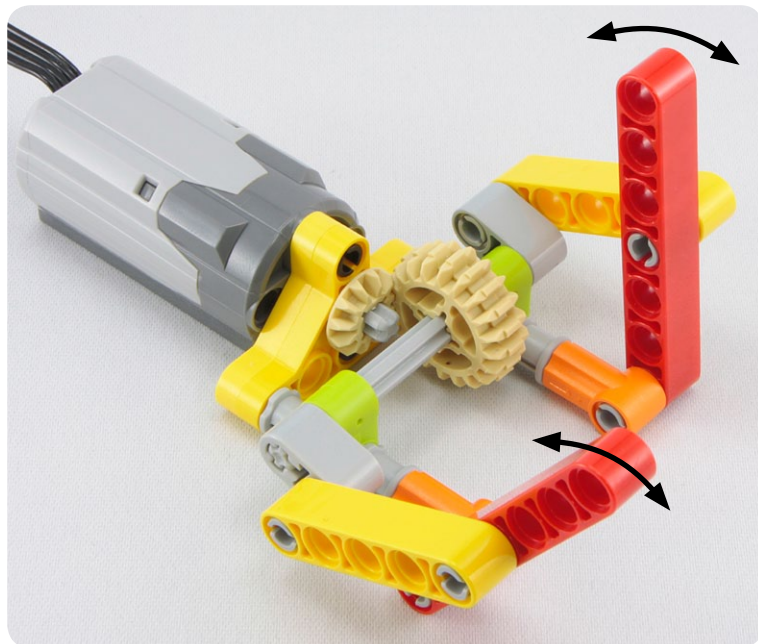
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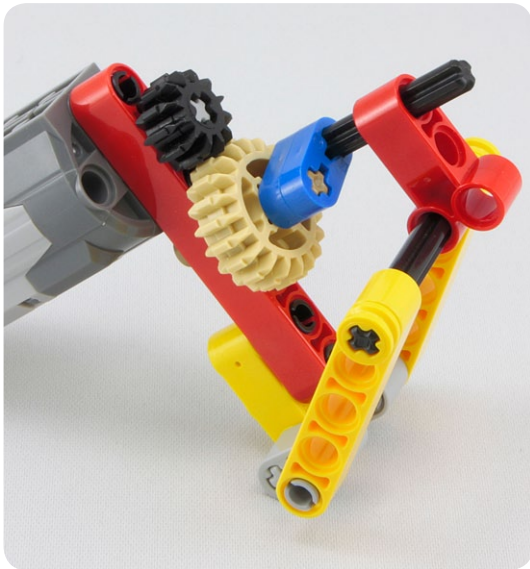
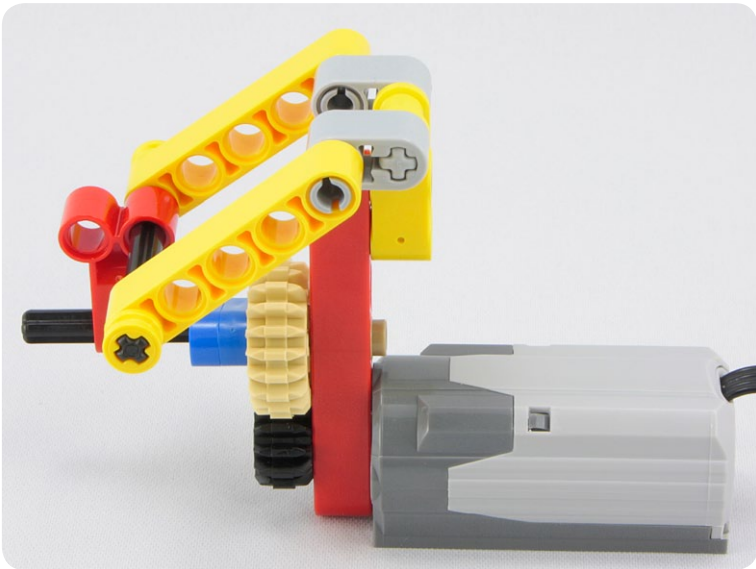
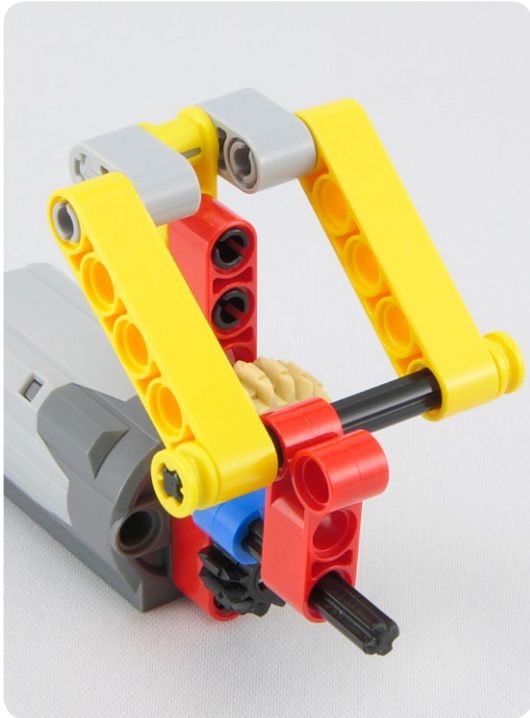
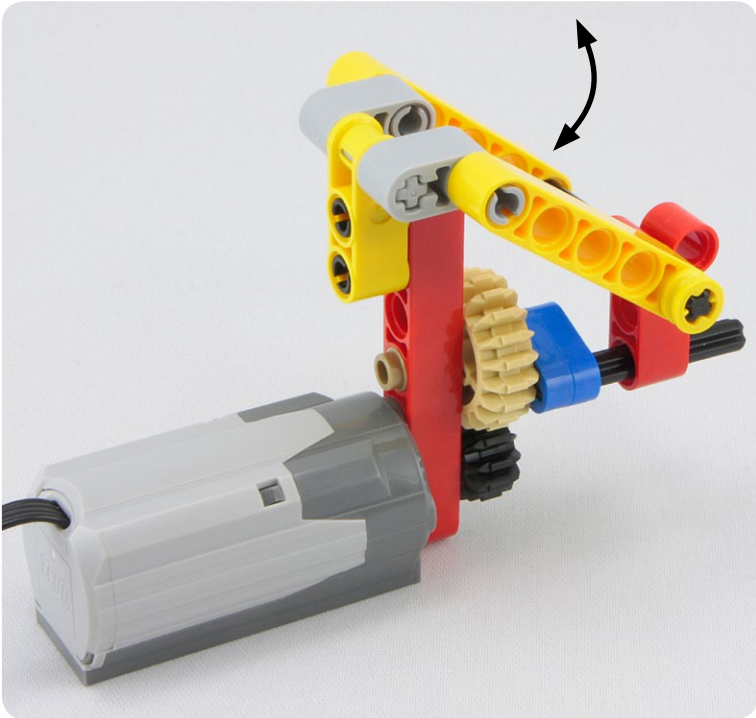
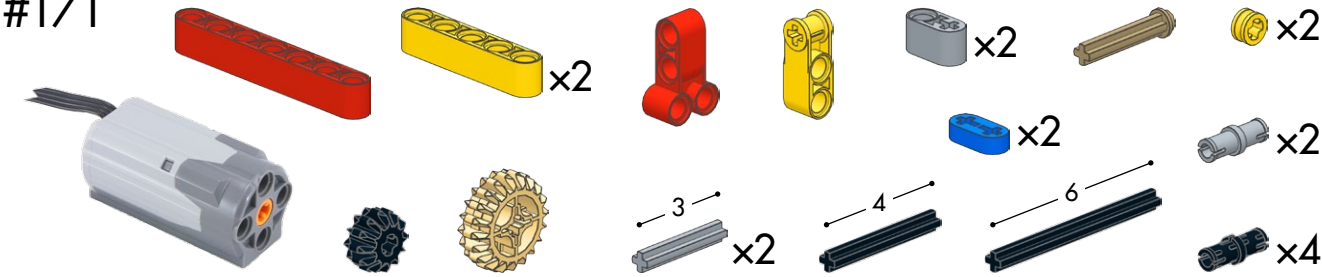


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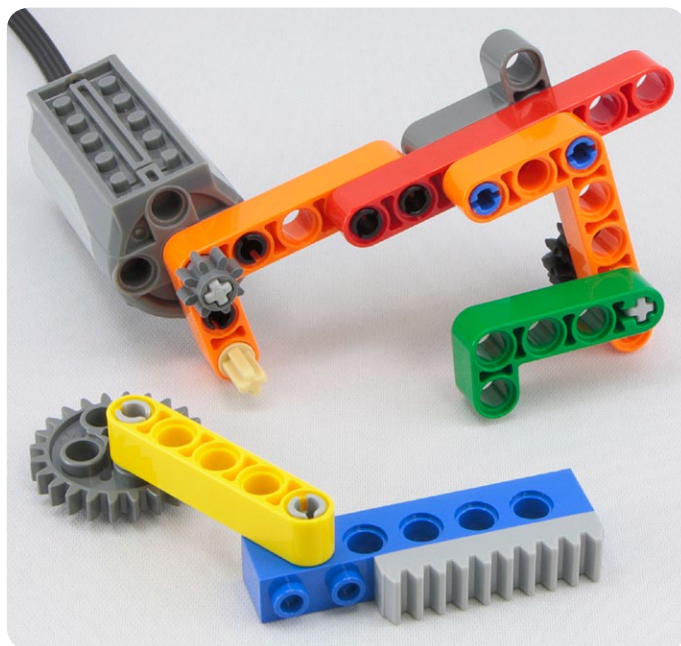
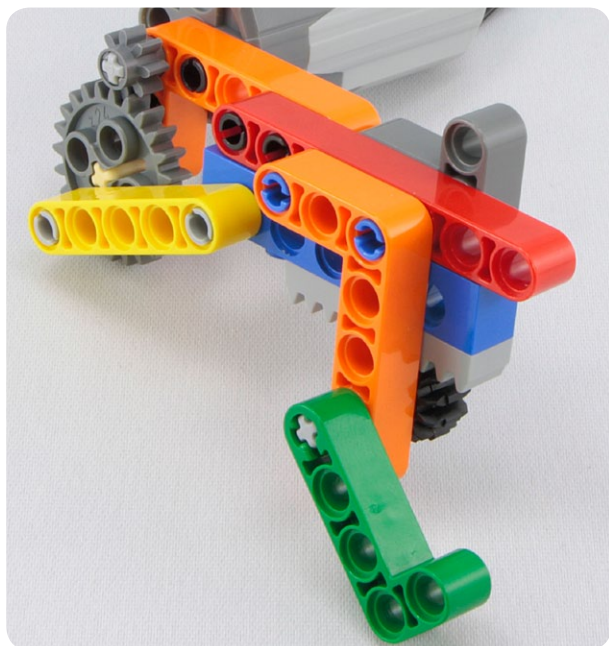
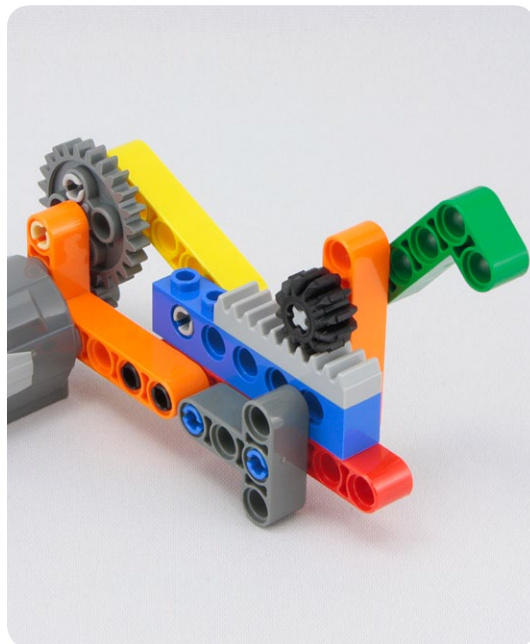
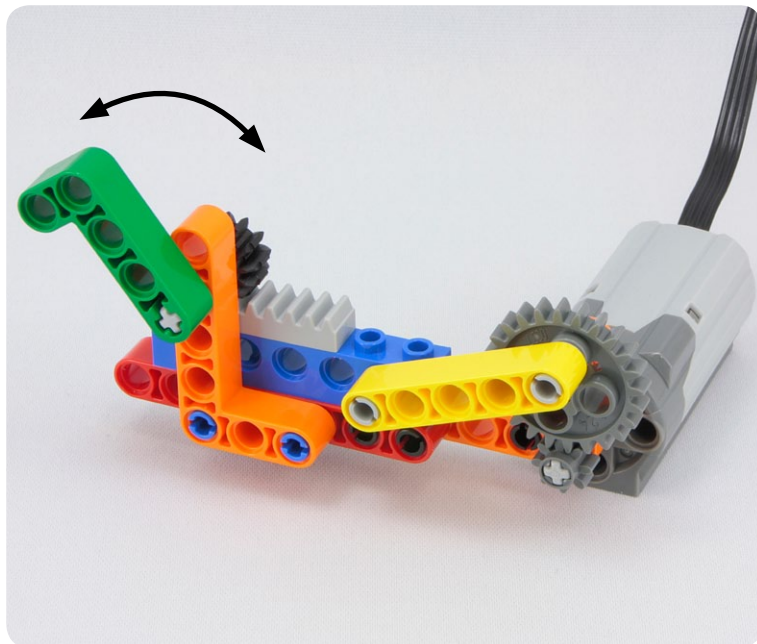
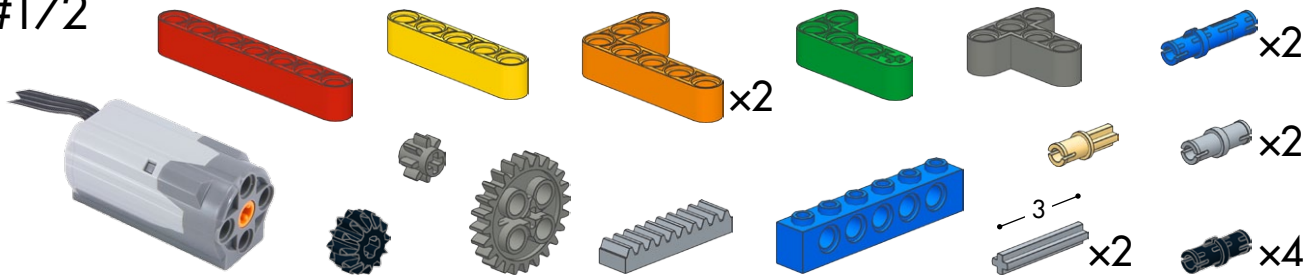


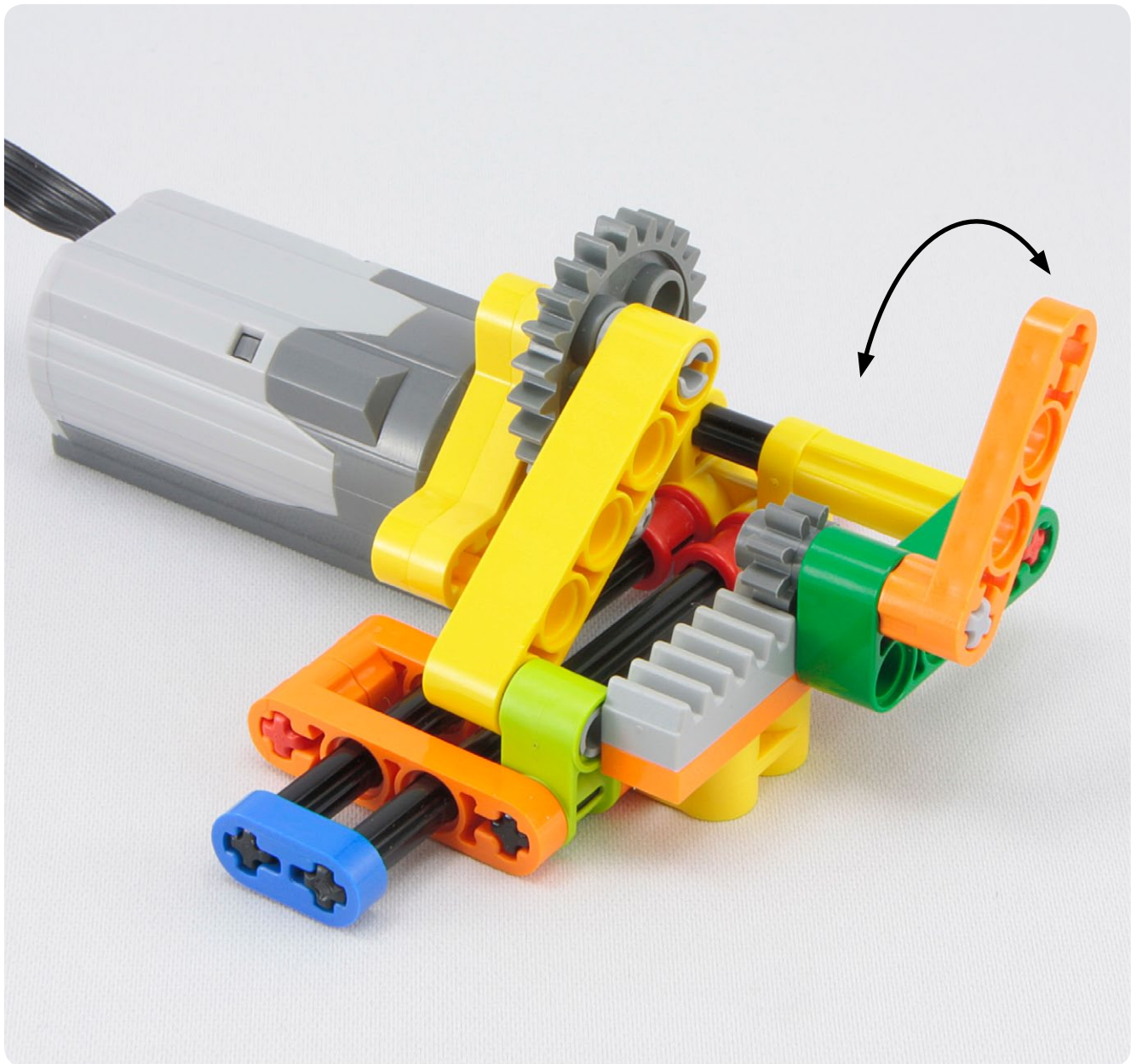
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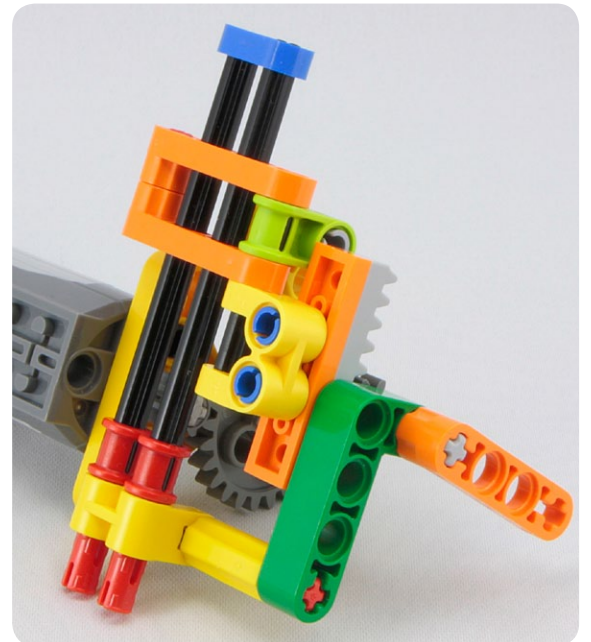
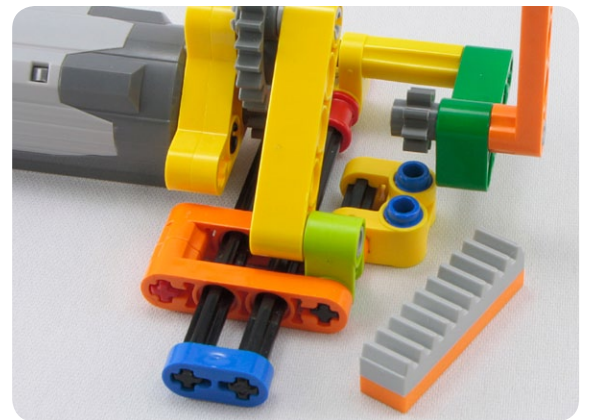
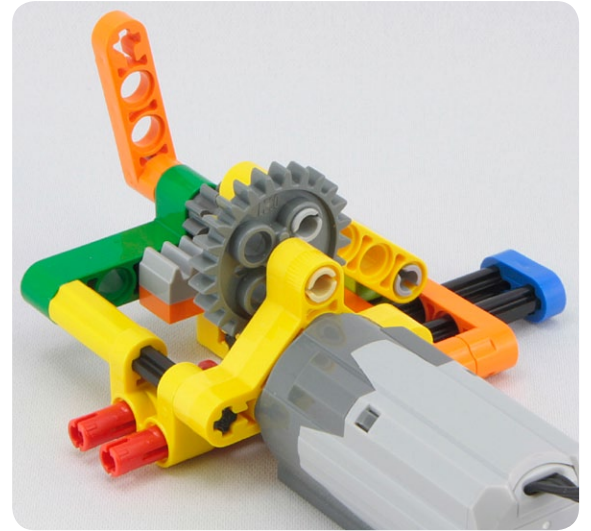
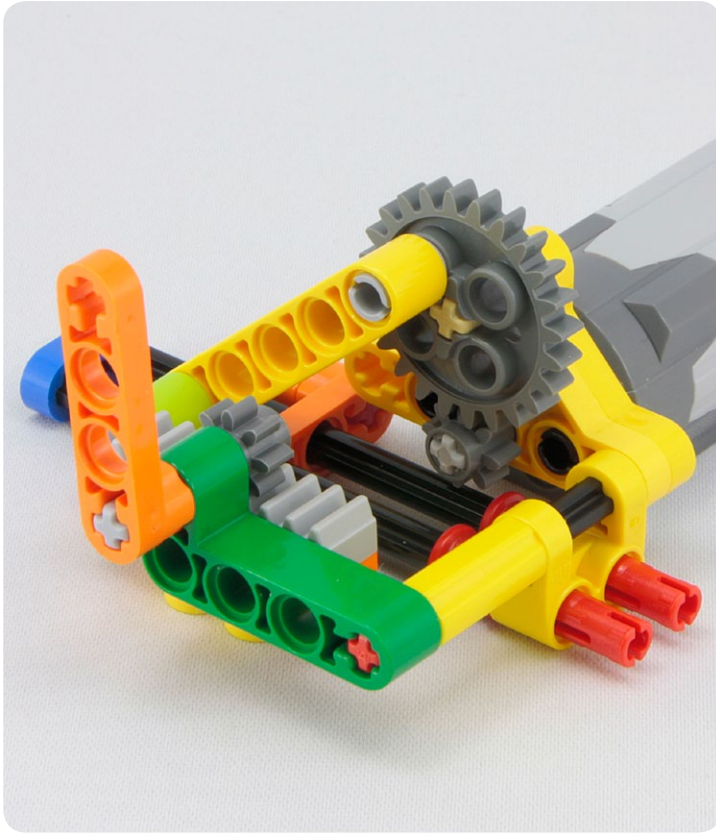
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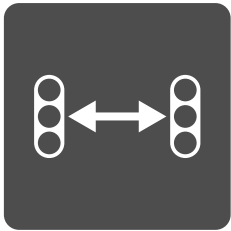


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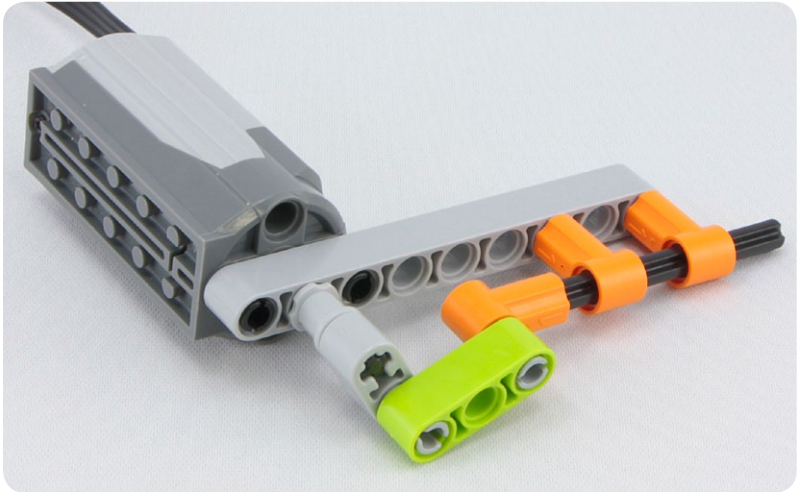
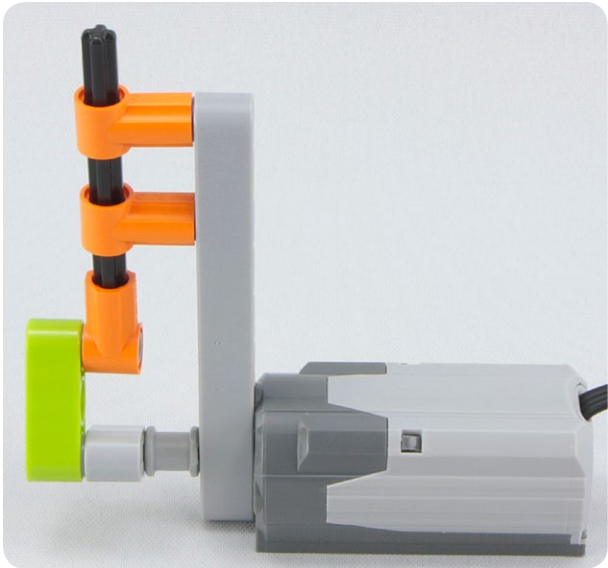
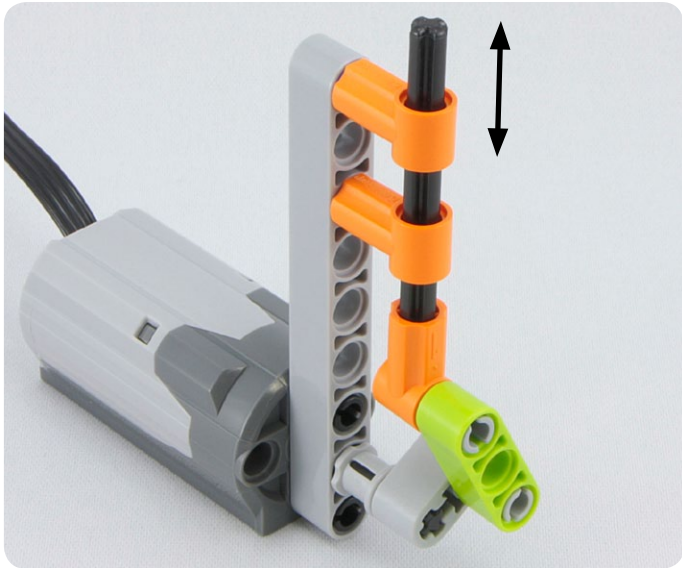
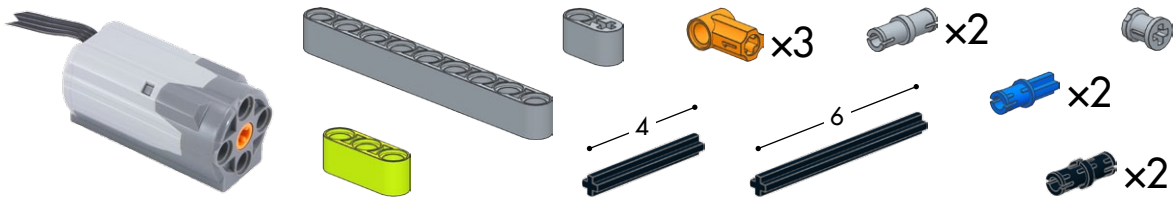
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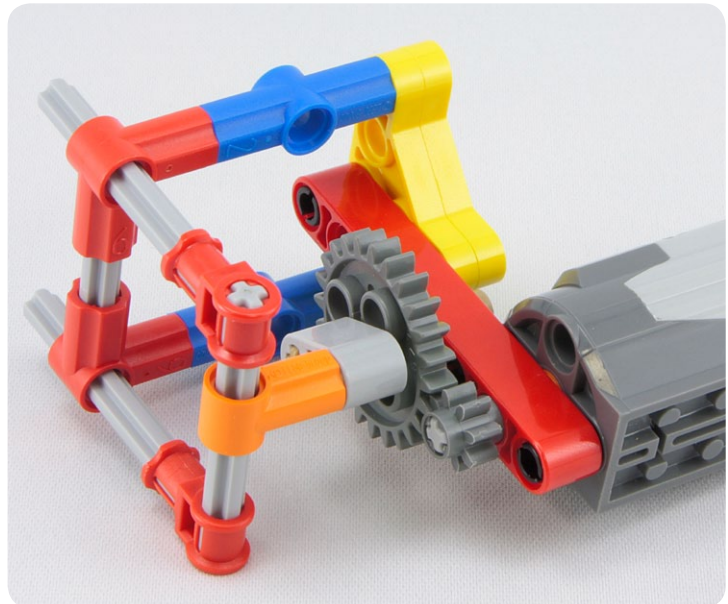
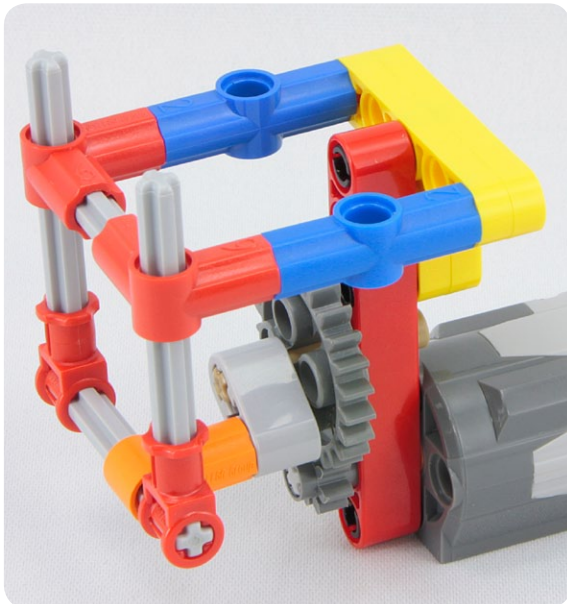
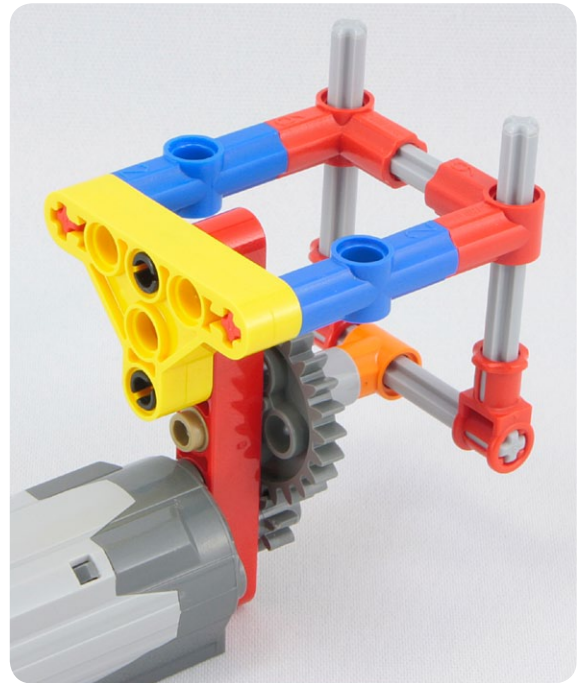
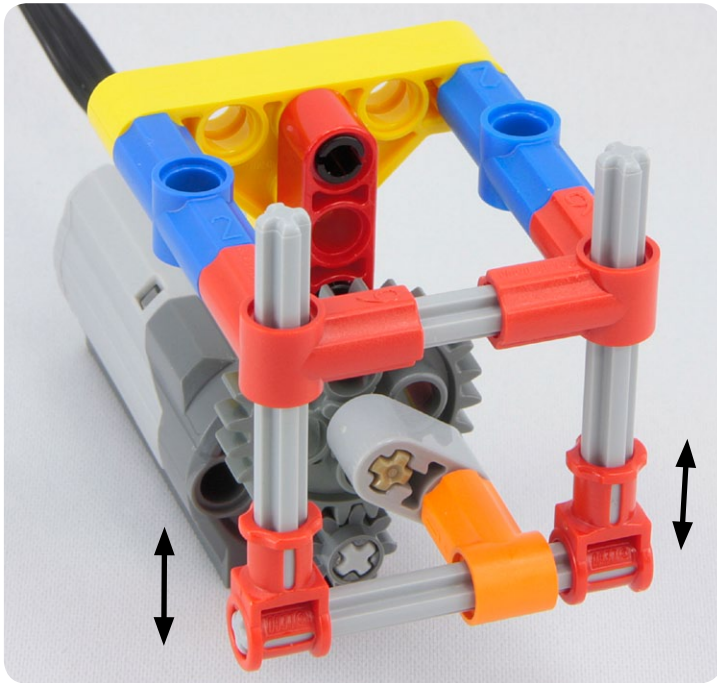


Reciprocating mechanisms

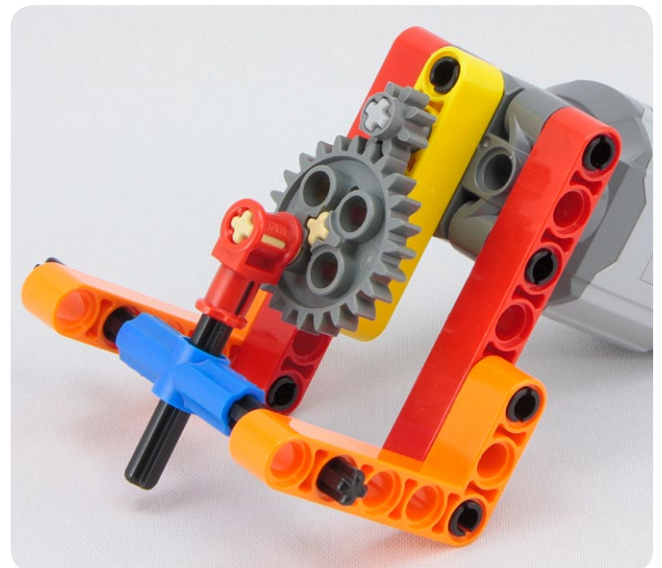
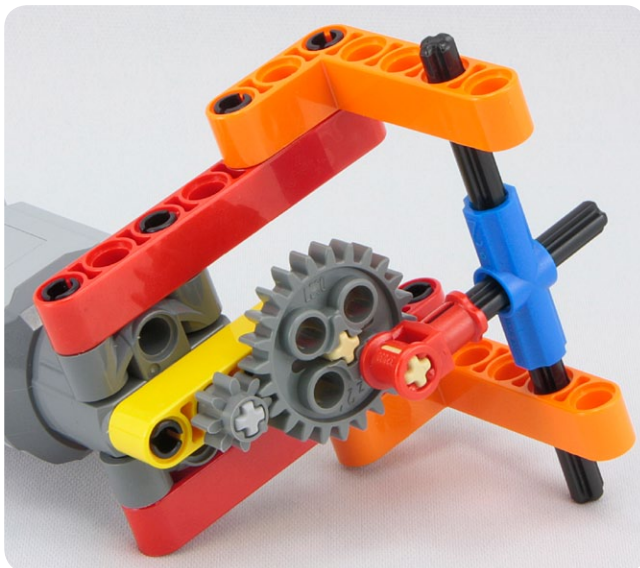
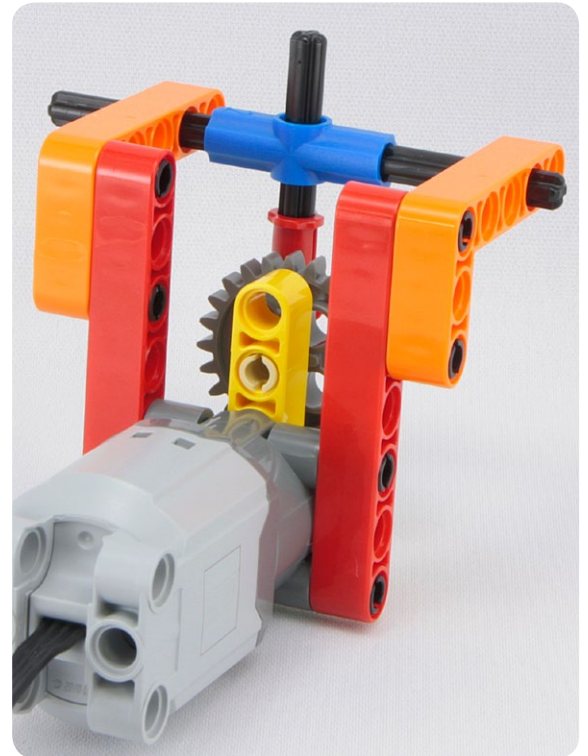
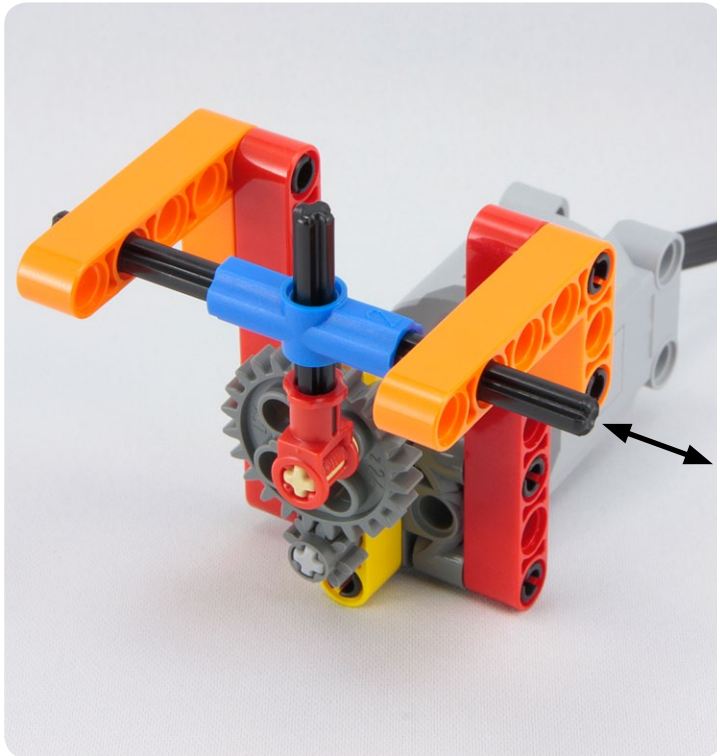
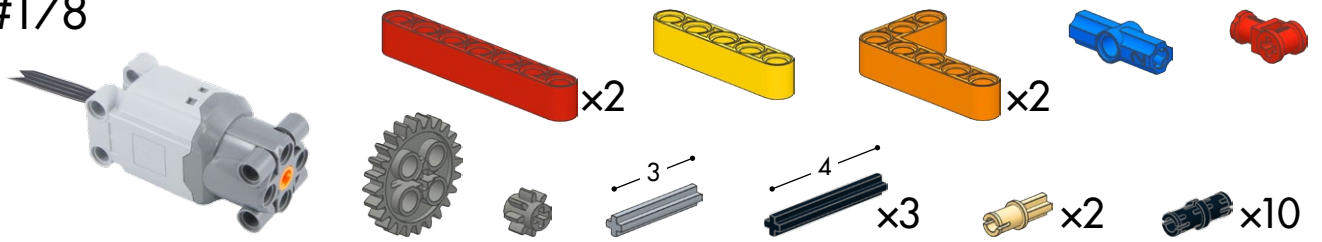
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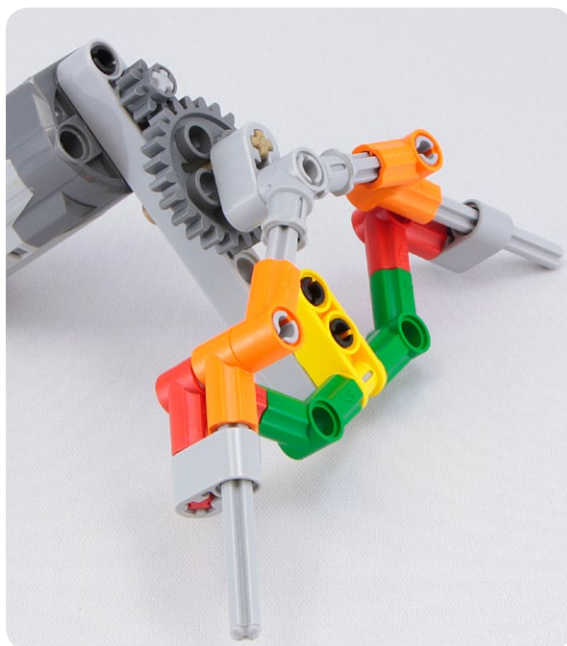
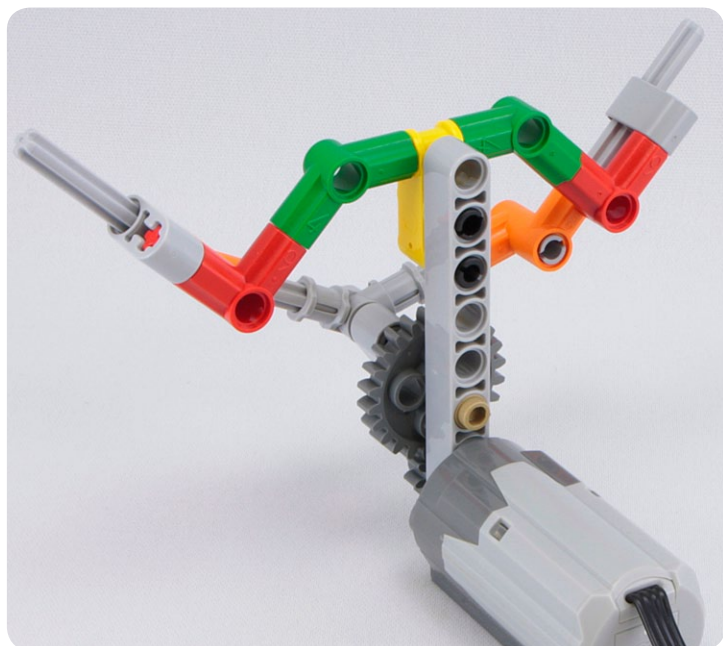
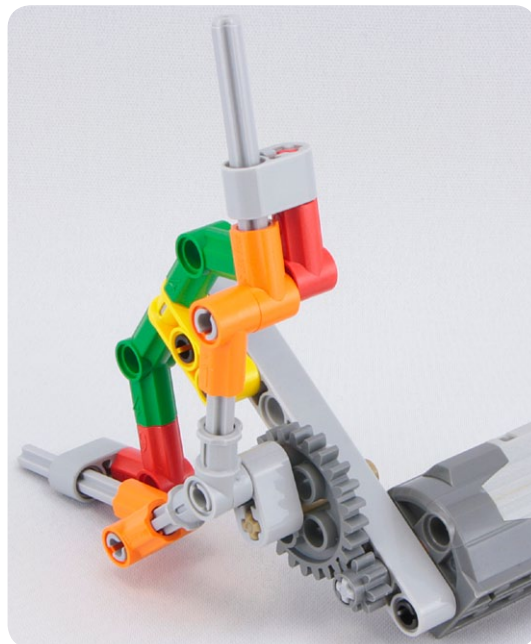
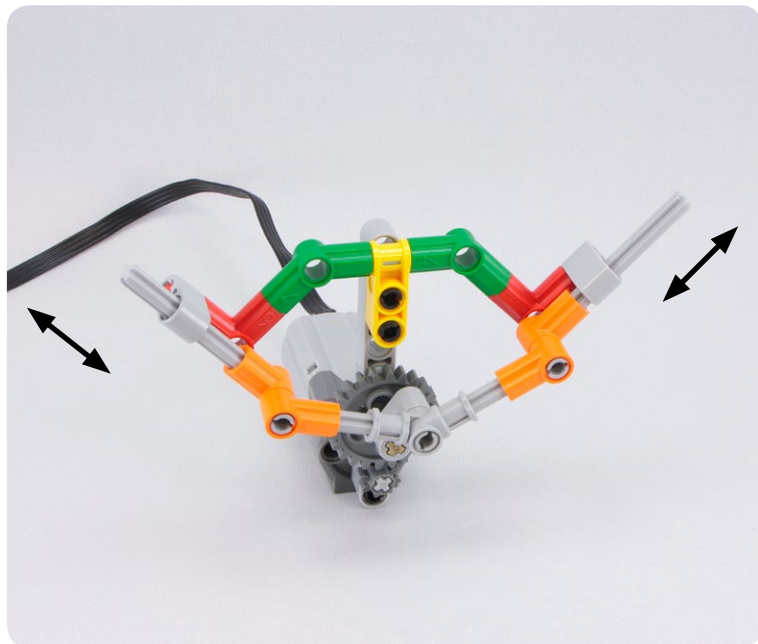
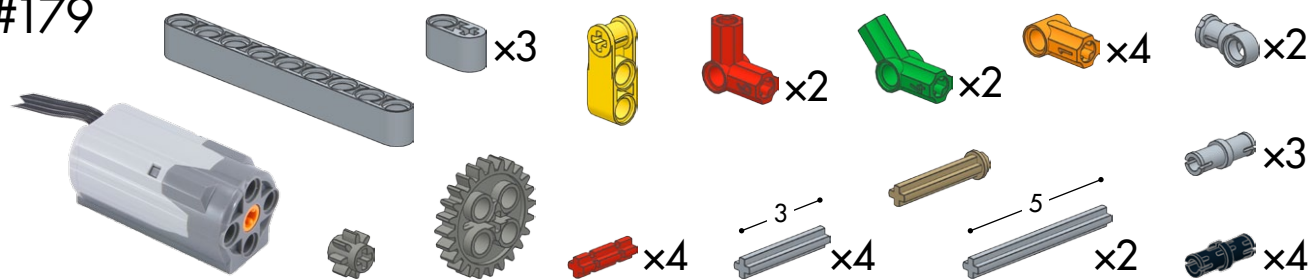
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[illegible]

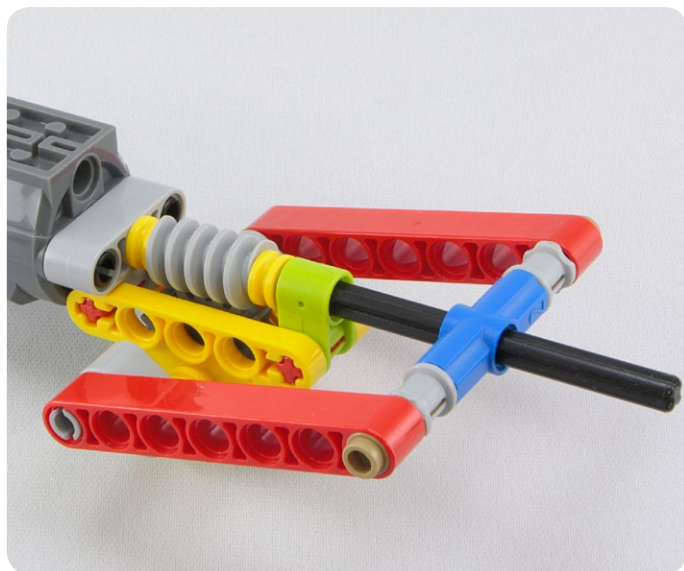
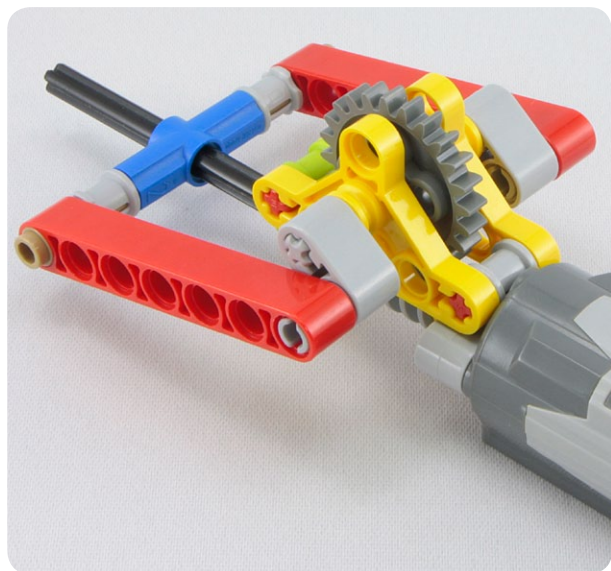
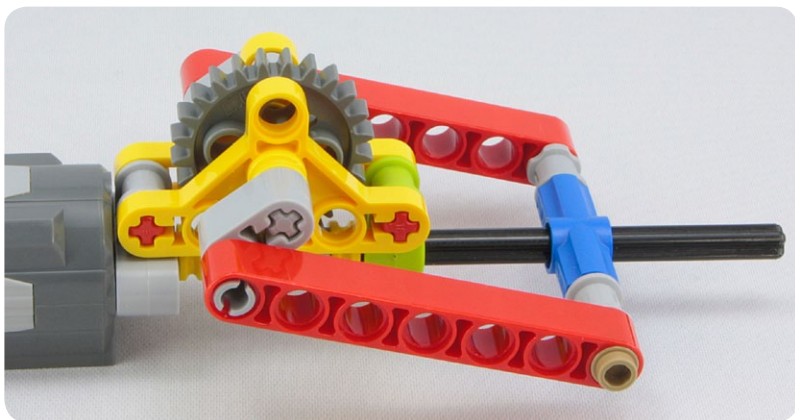
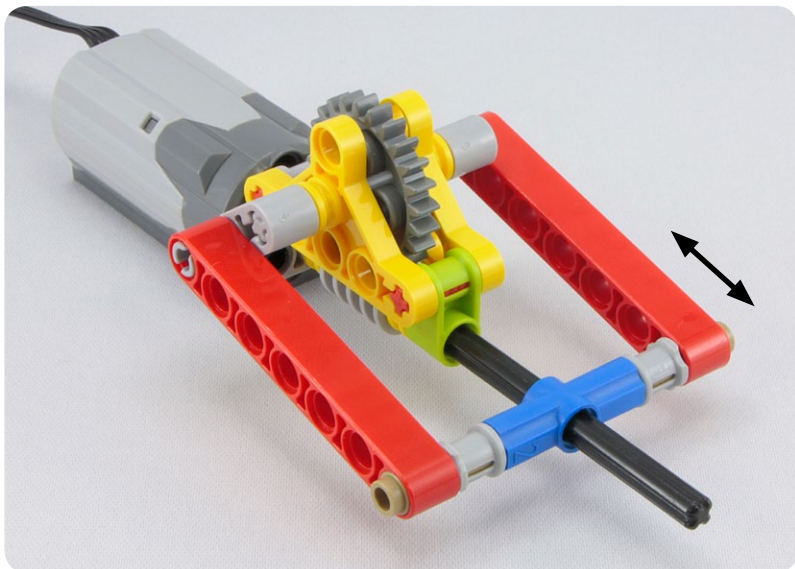
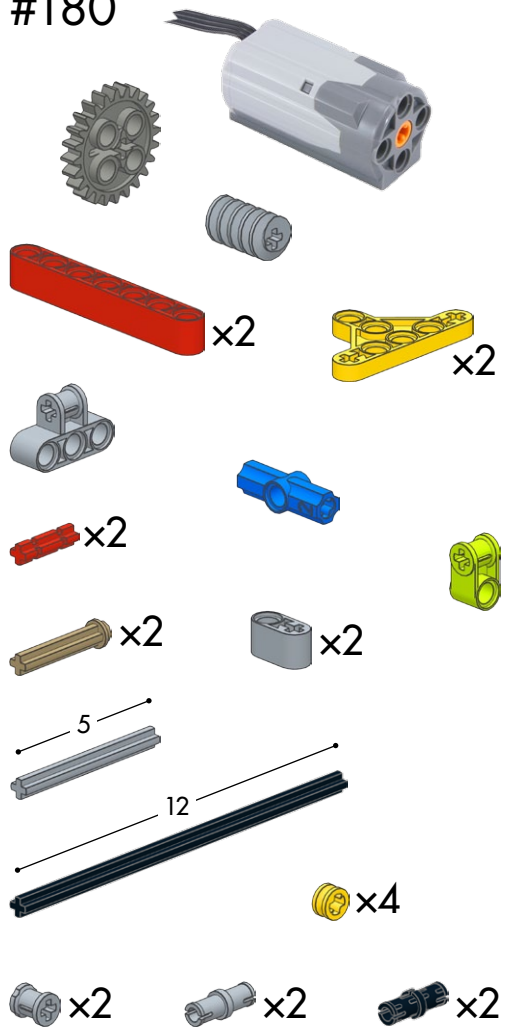
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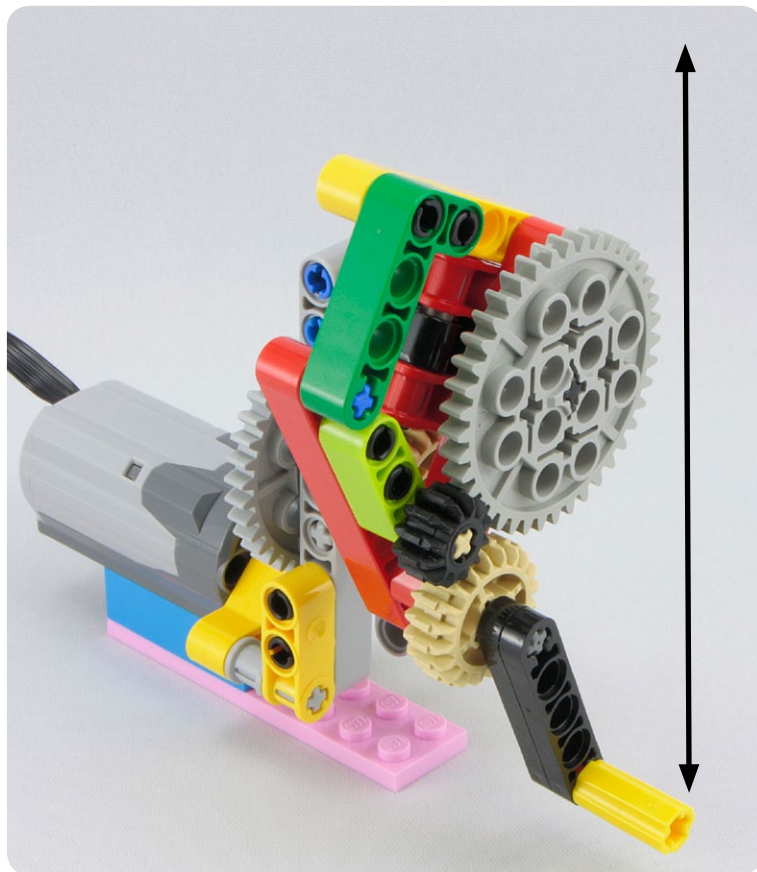
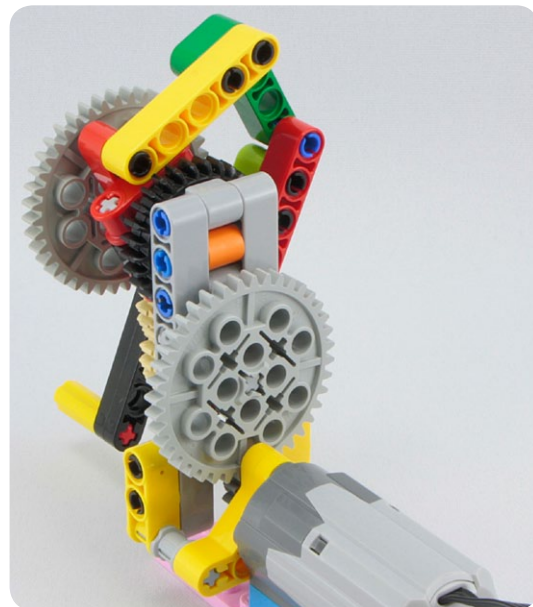


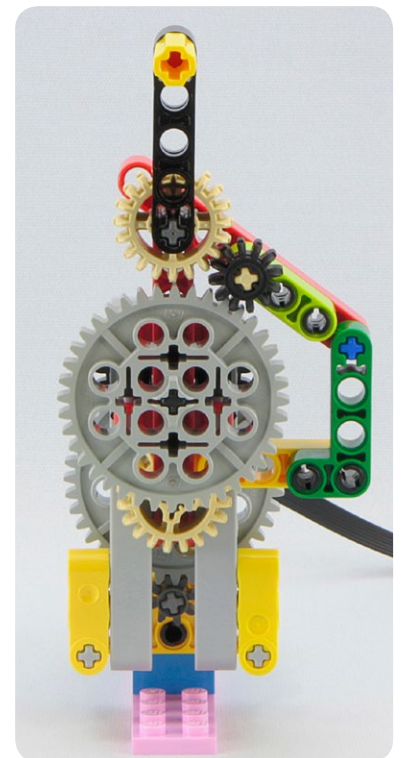
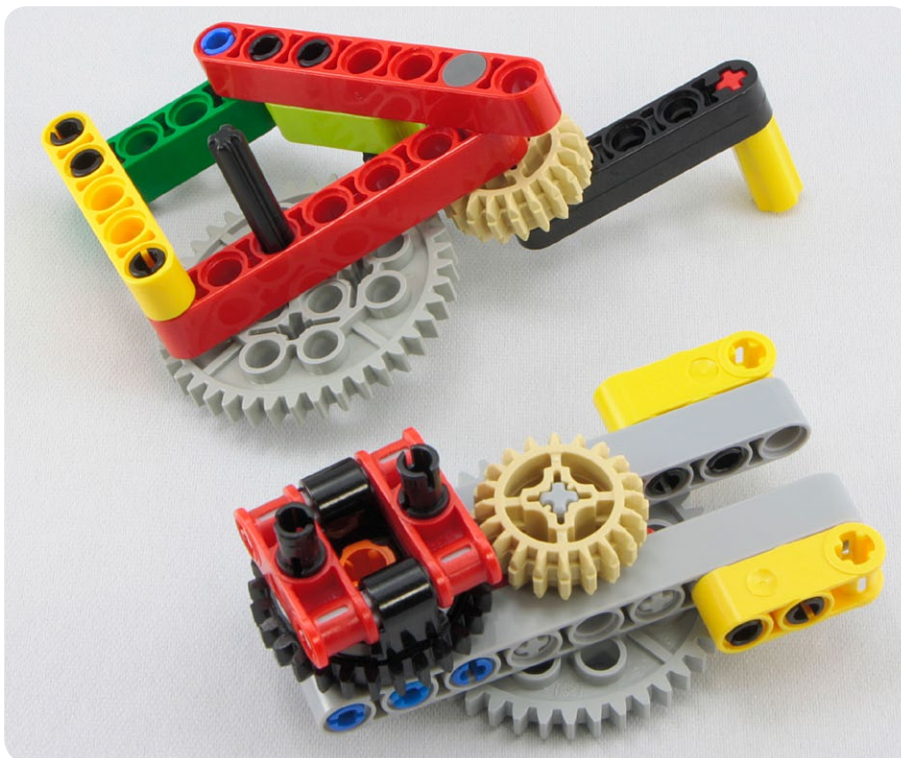
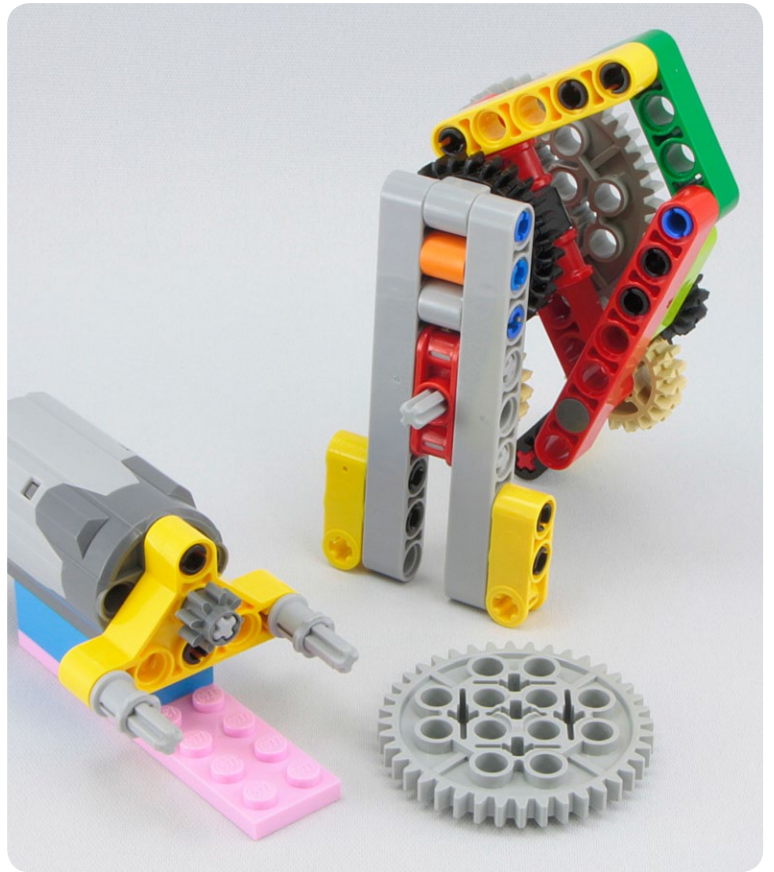
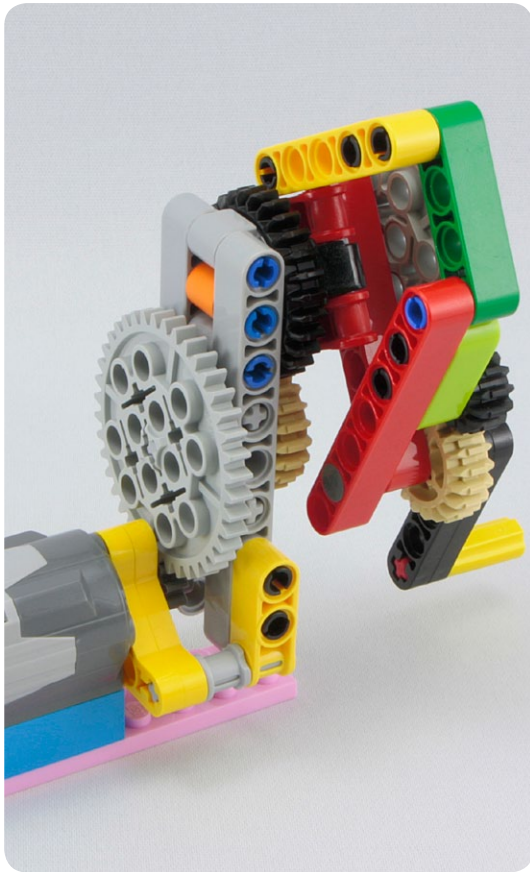
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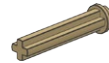


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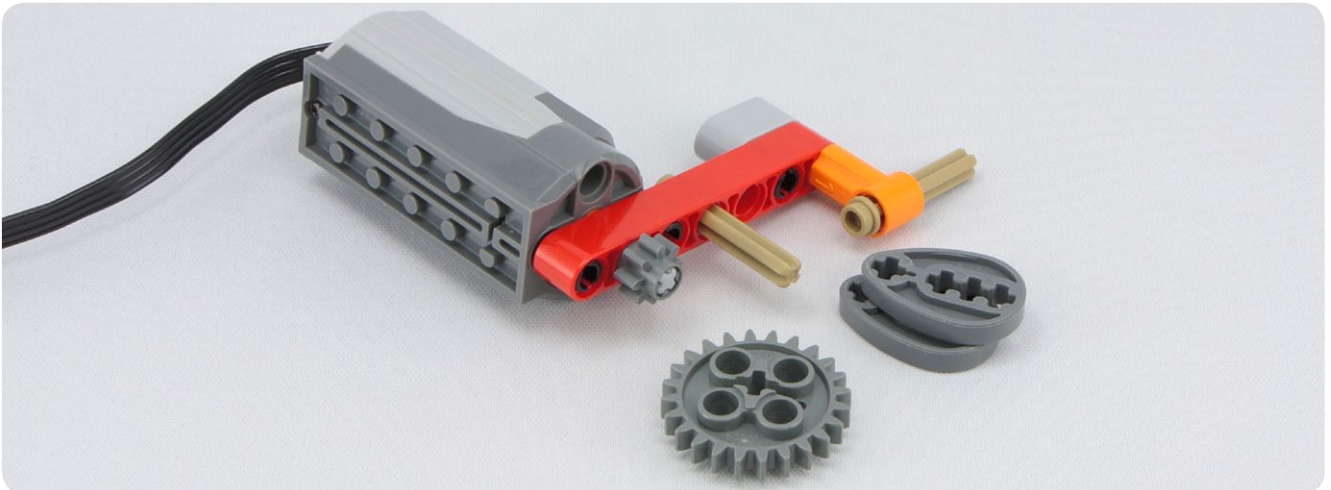
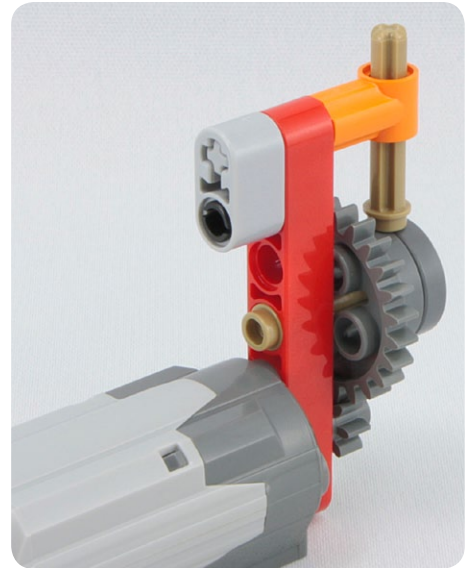


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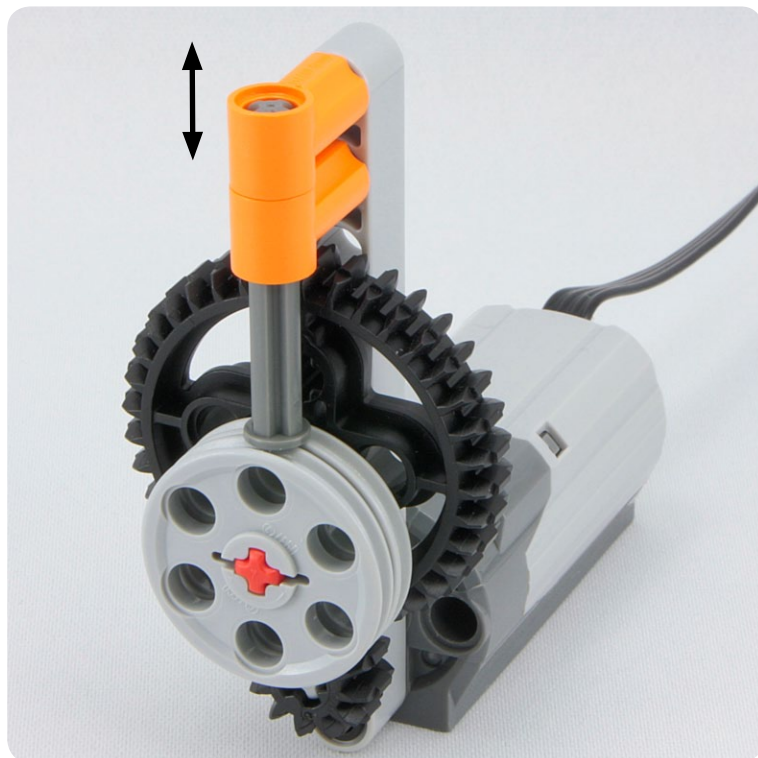
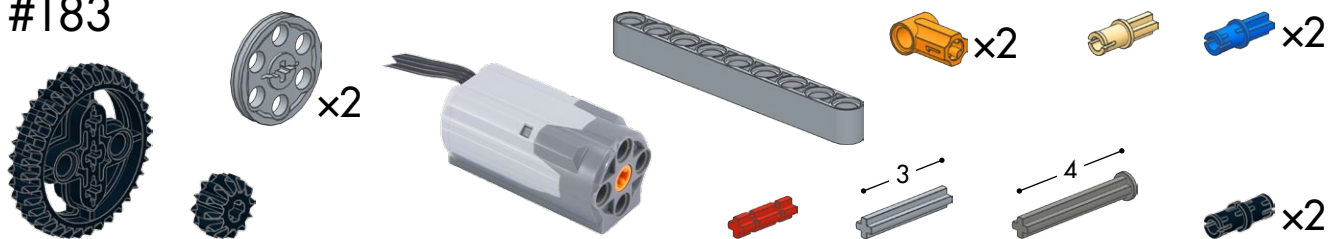


 $\times 2$ 

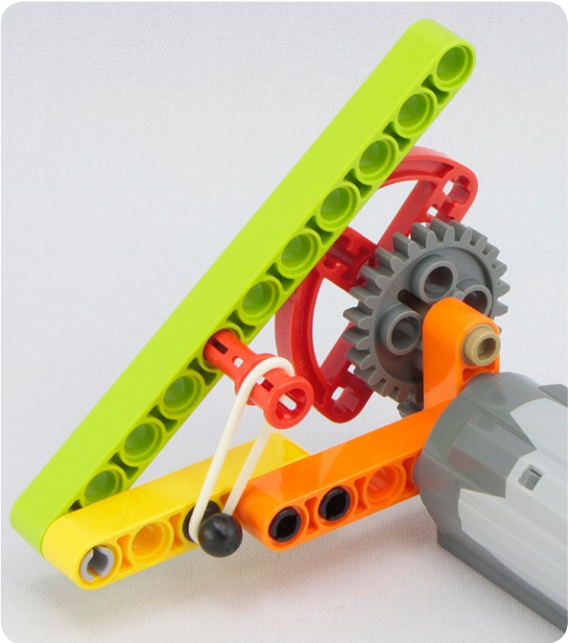
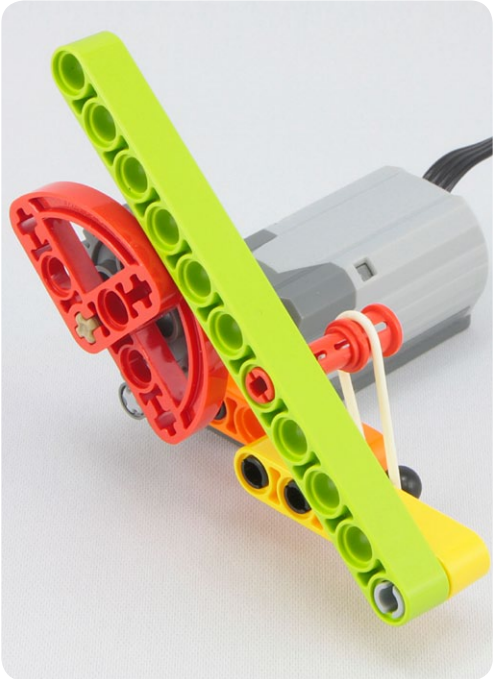
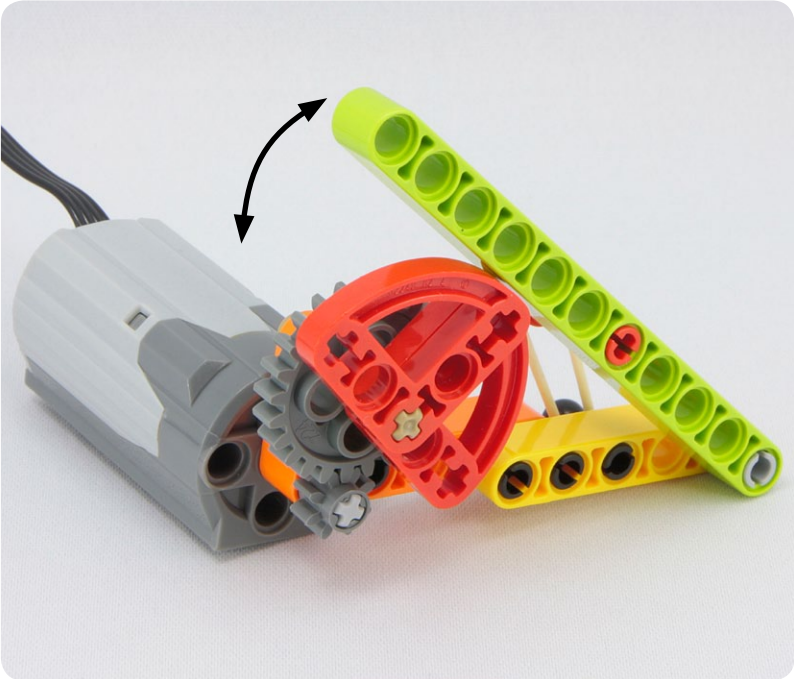
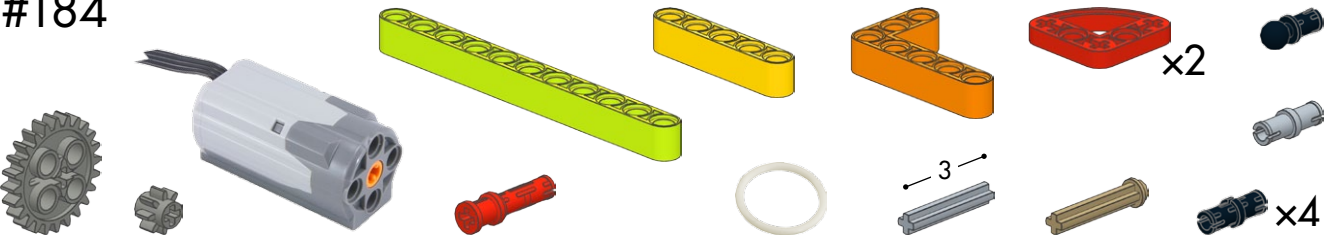
x2

 x3

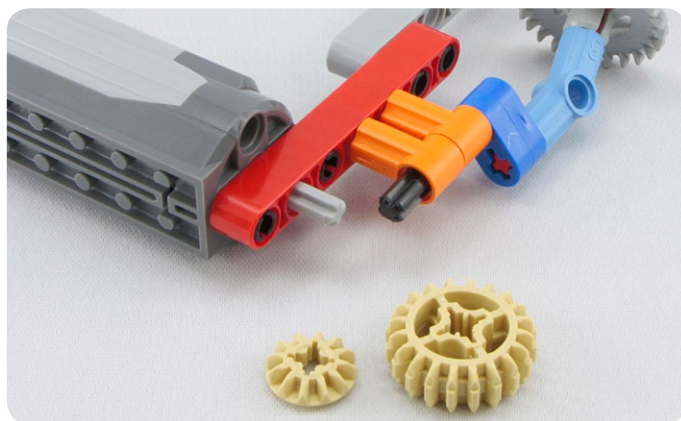
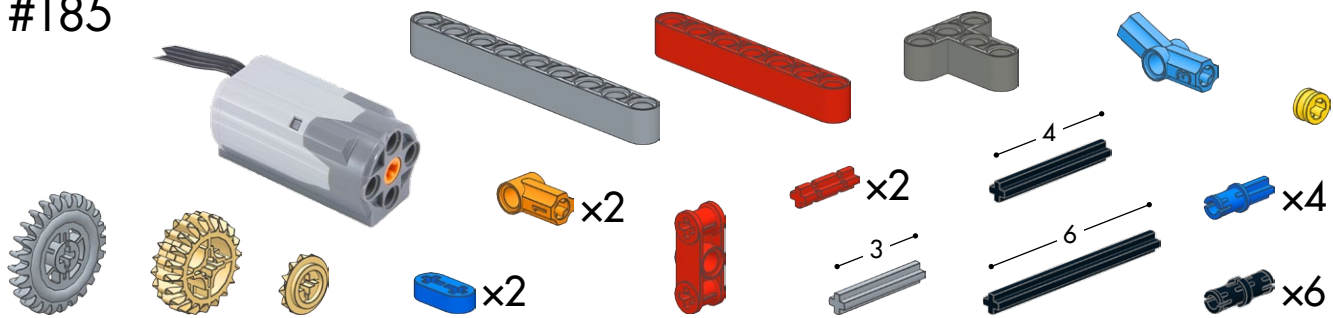
#183



#184



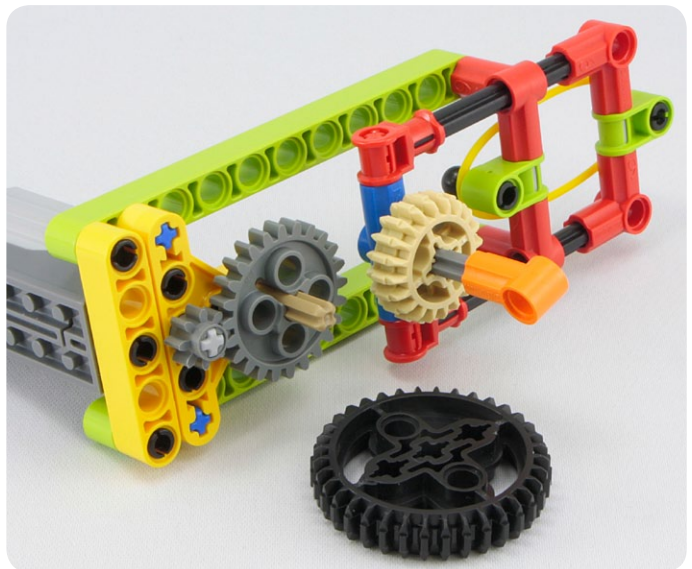
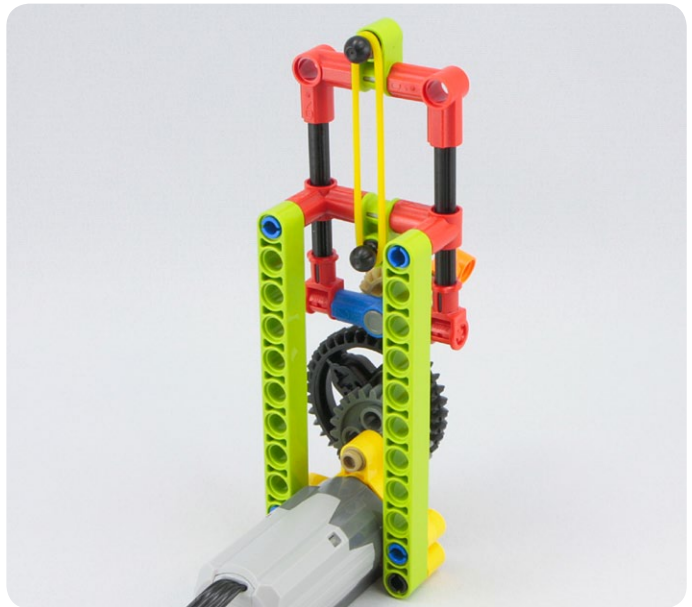
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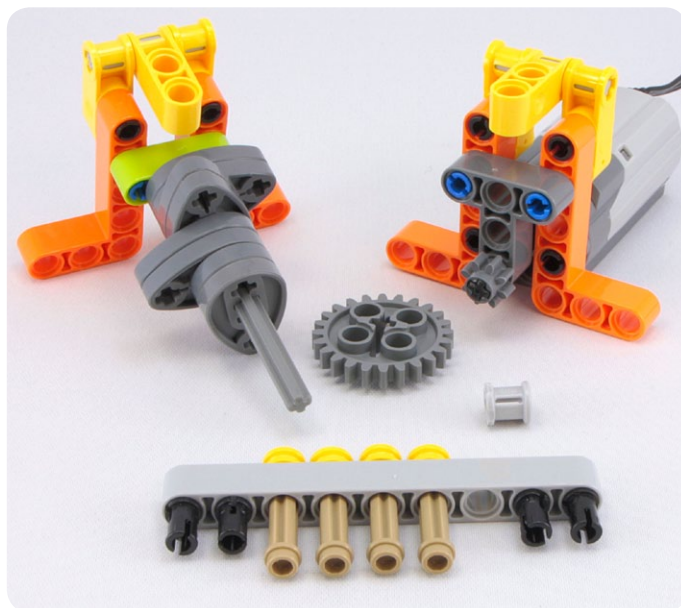
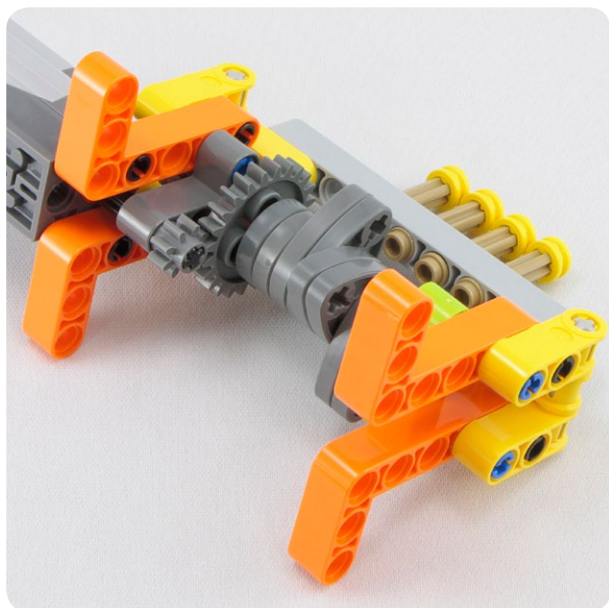
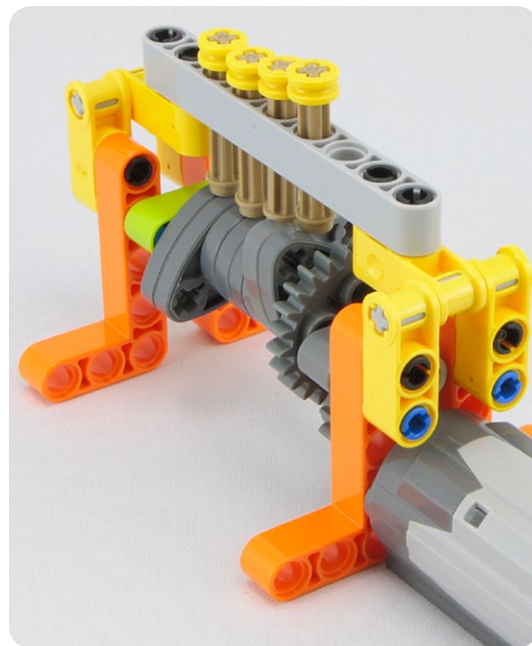
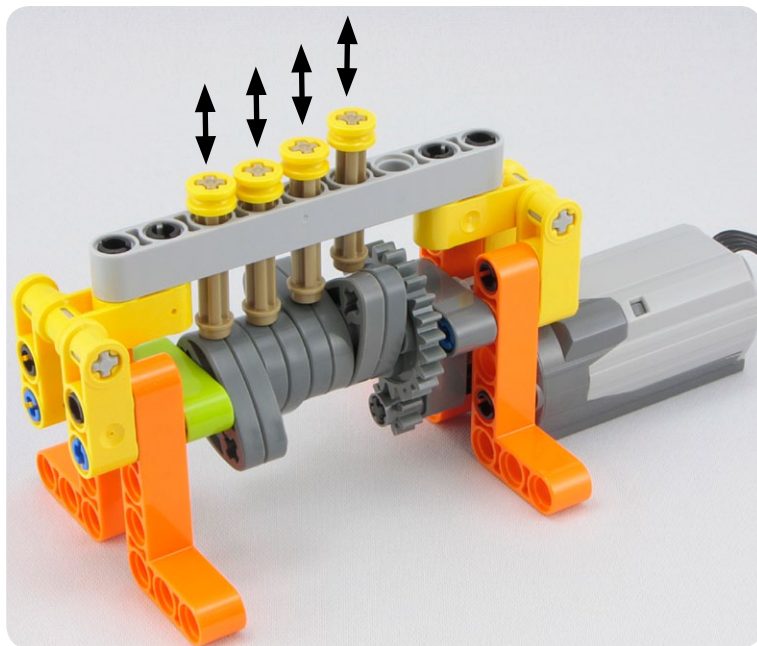
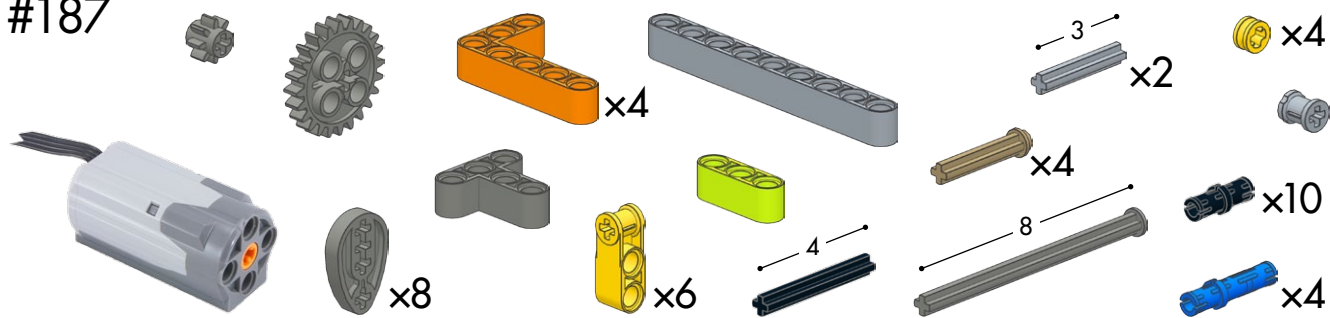
#186

This image displays the components required for step 186 of a LEGO construction project. The parts are arranged as follows:

- One grey motor.
- Two long green Technic beams (length 11).
- One yellow Technic beam (length 5).
- Two yellow L-shaped Technic connectors.
- Two red T-shaped Technic connectors.
- One tan axle (length 3).
- Four red right-angle Technic connectors.
- One blue T-shaped Technic connector.
- One orange T-shaped Technic connector.
- Two red short pins.
- Two light green T-shaped Technic connectors.
- A set of four grey axles of length 4.
- Two black pins.
- Three grey axles of length 3.
- A set of two black axles of length 6.
- Four blue pins.
- Six black pins.
- One large black gear (40 teeth).
- One medium grey gear (24 teeth).
- One small grey gear (12 teeth).
- One tan gear (24 teeth).
- One yellow rubber band.



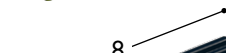
#187

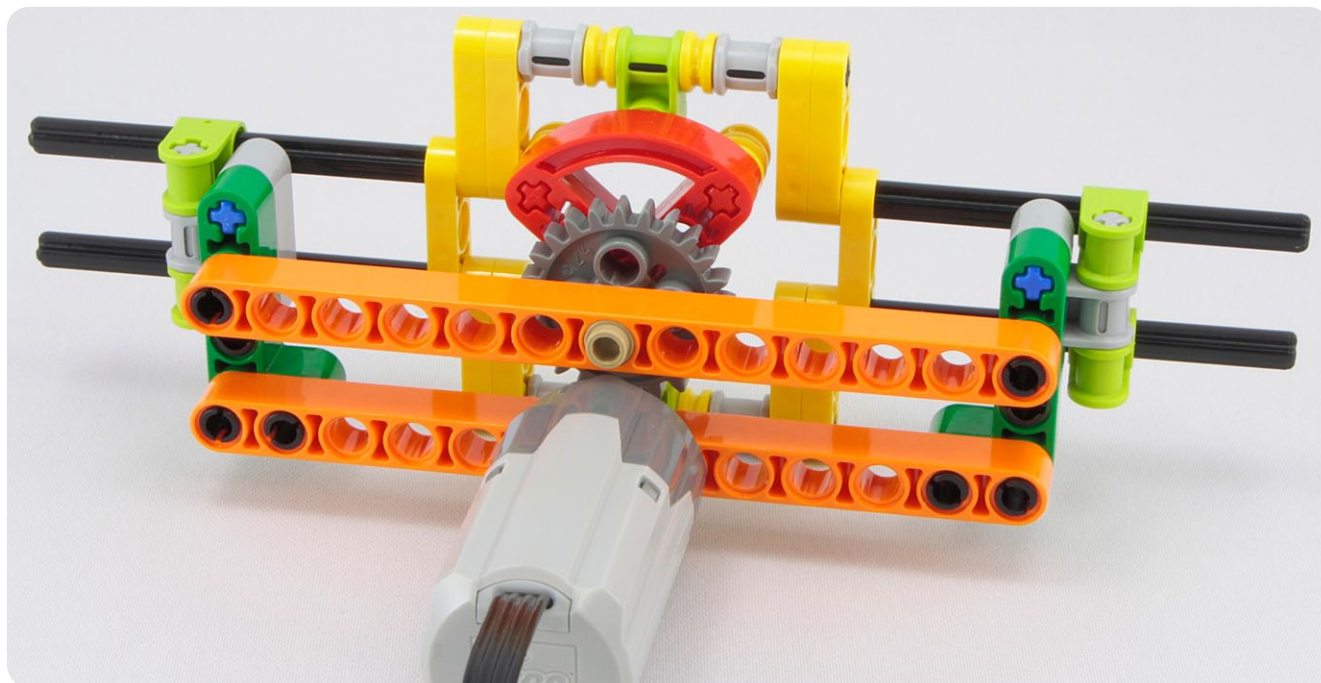
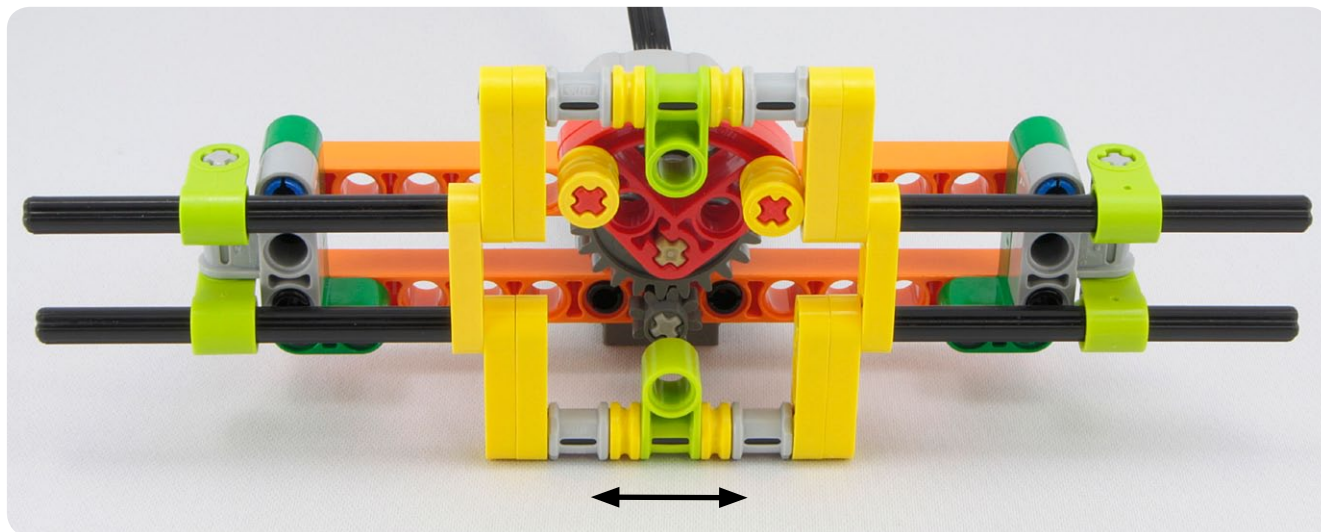


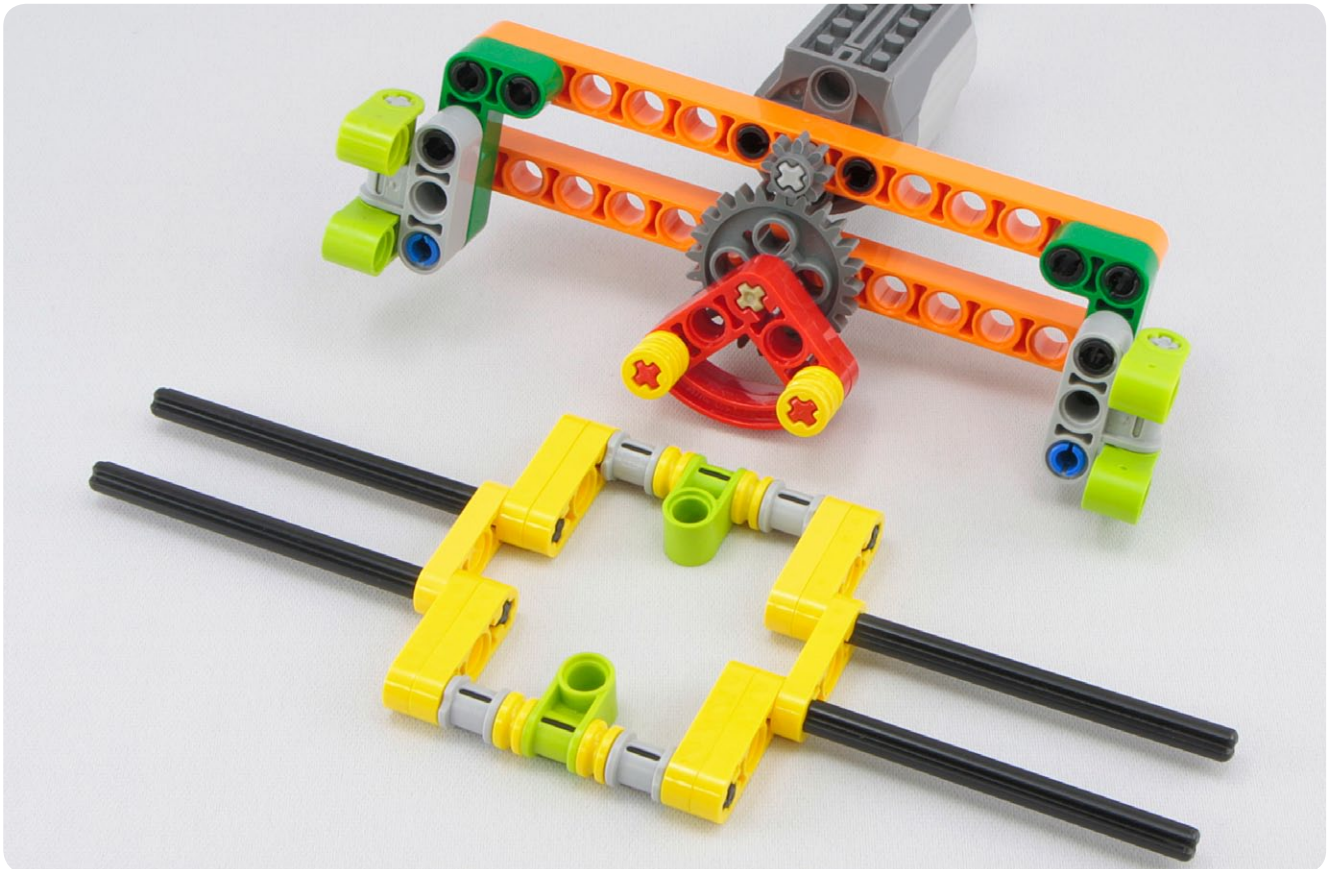
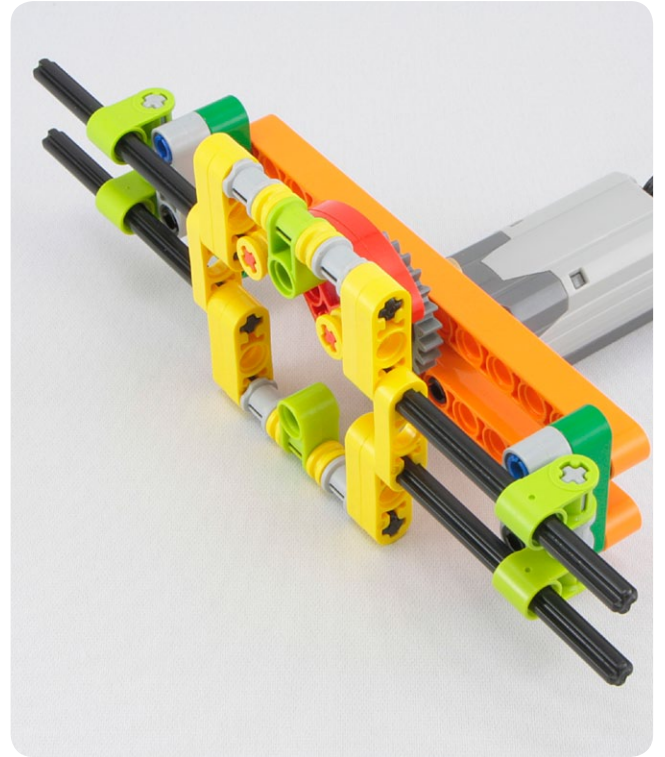
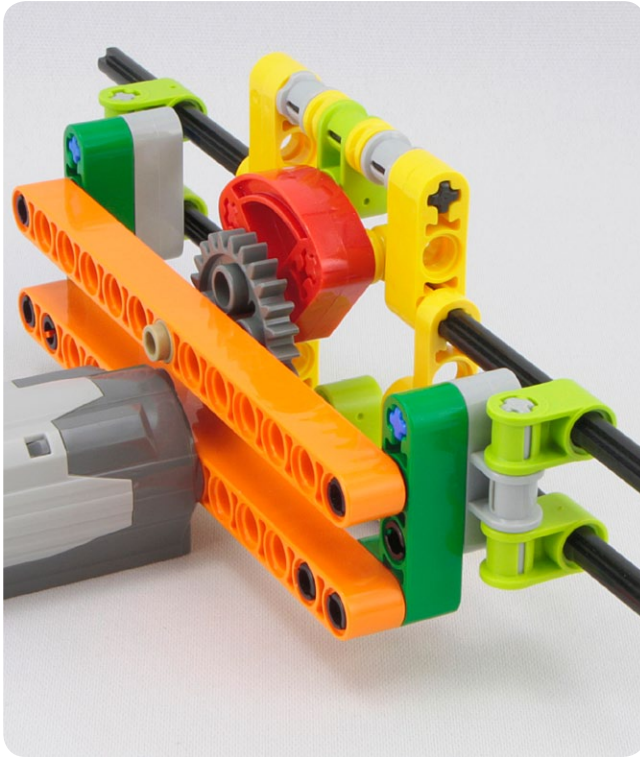
 x2
 x2
 x2
 x2
 x8

 x10
 x6
 x4

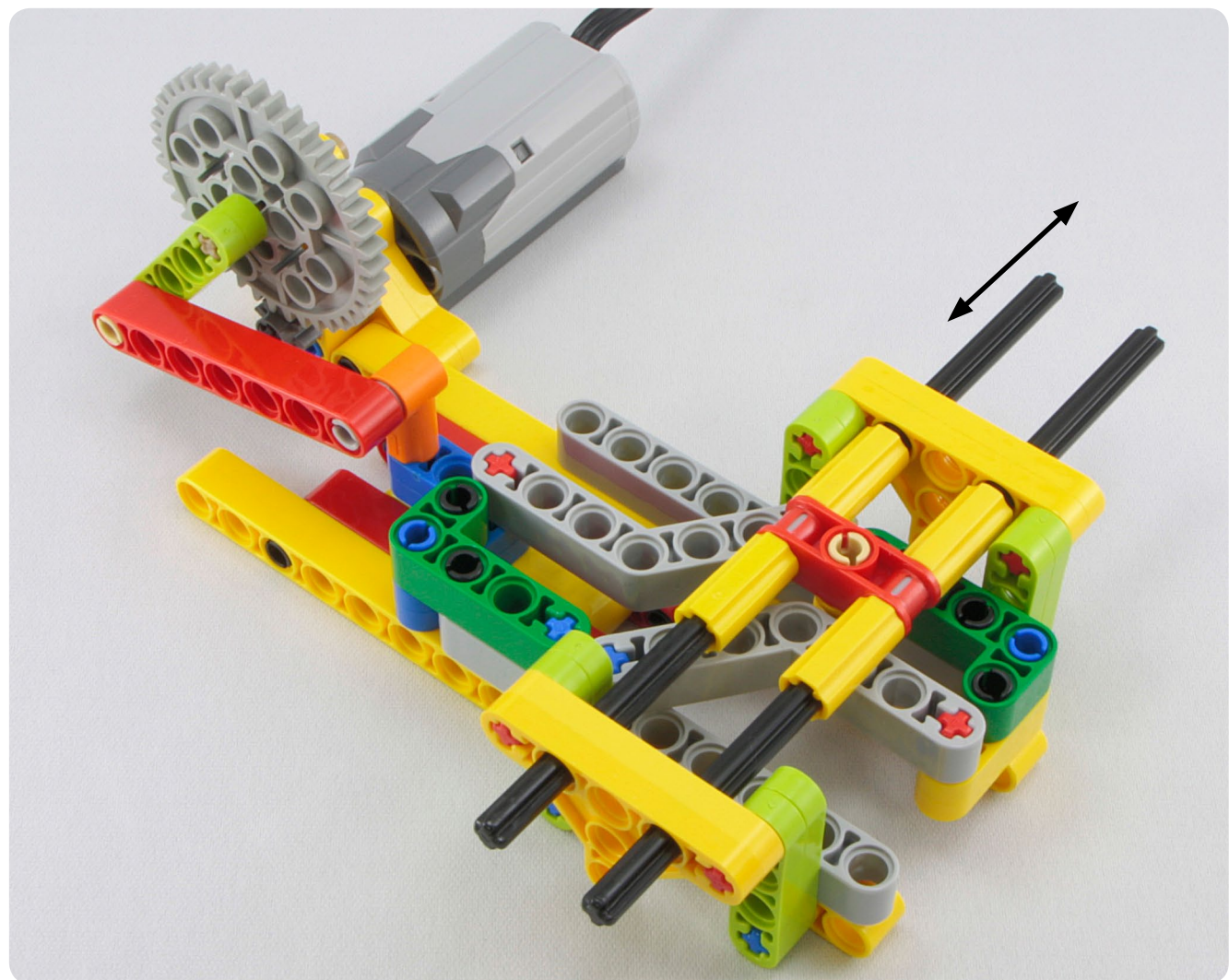
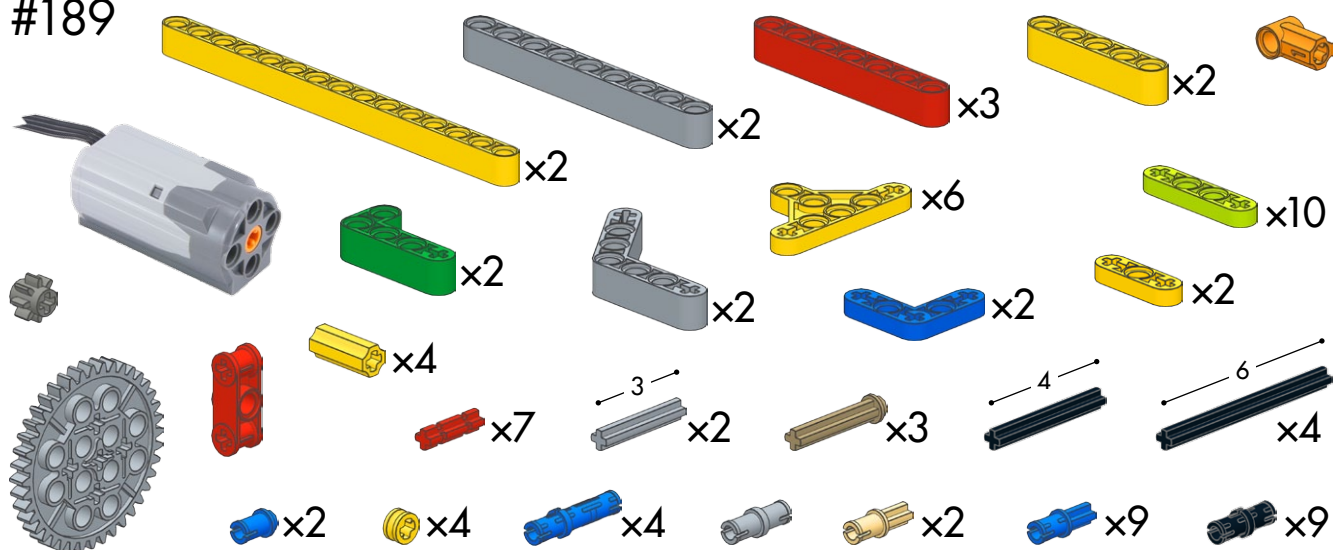
 x3
 x2

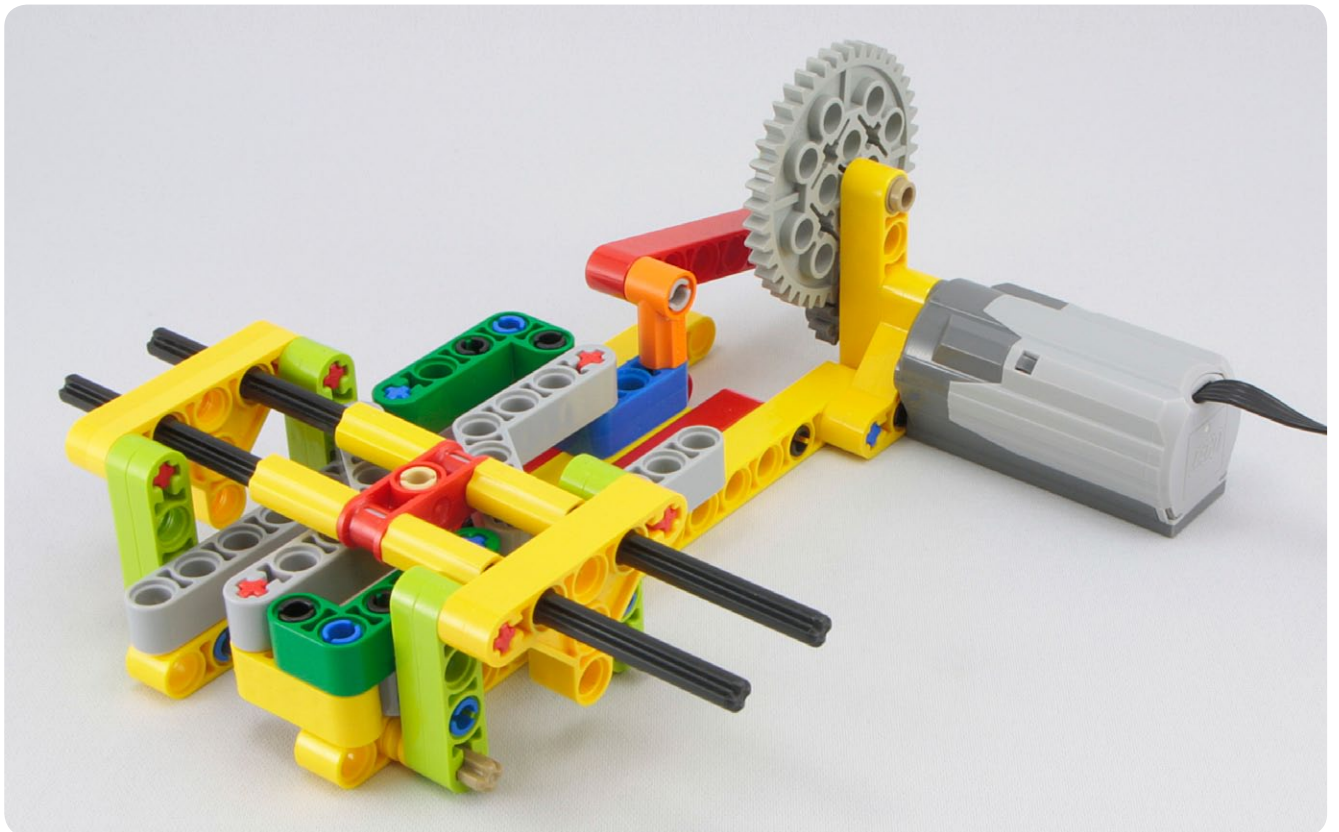
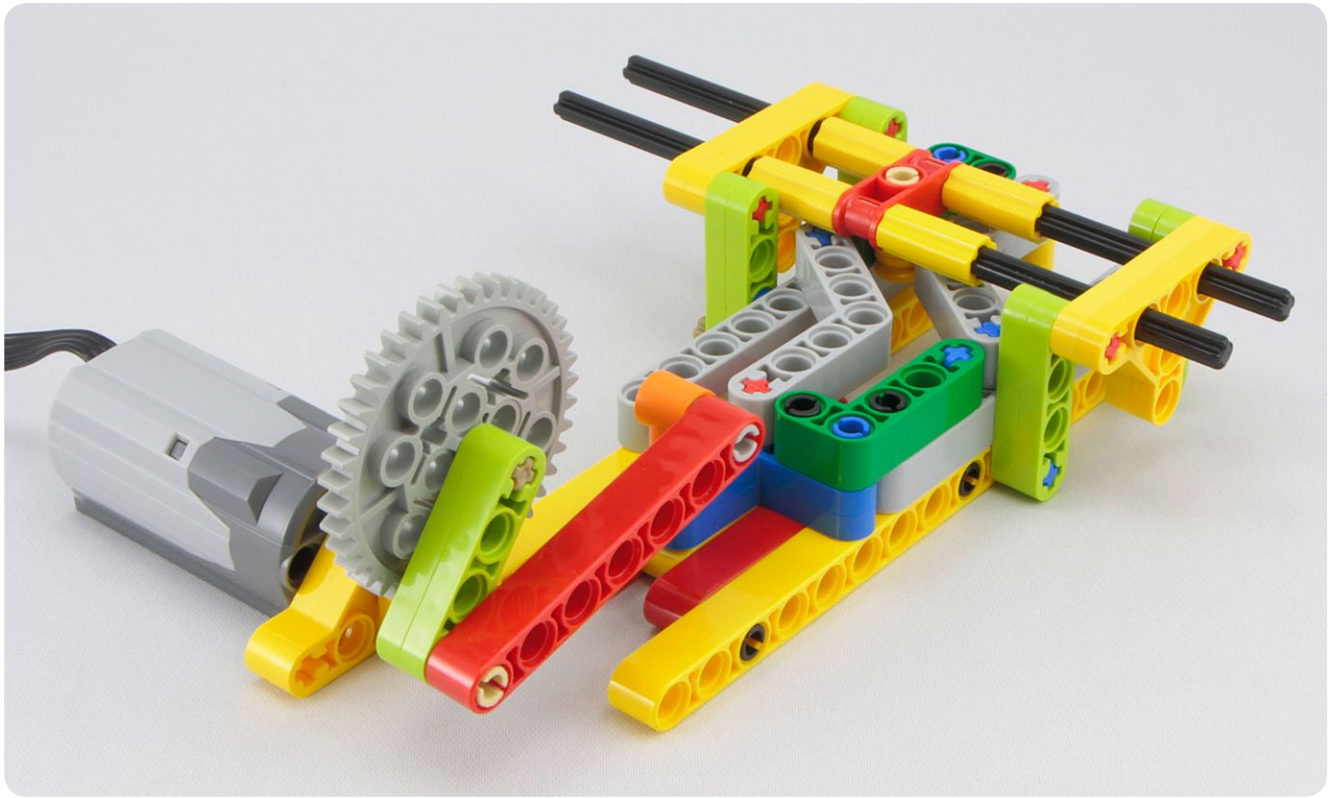
 x2
 x4
 x2
 x10

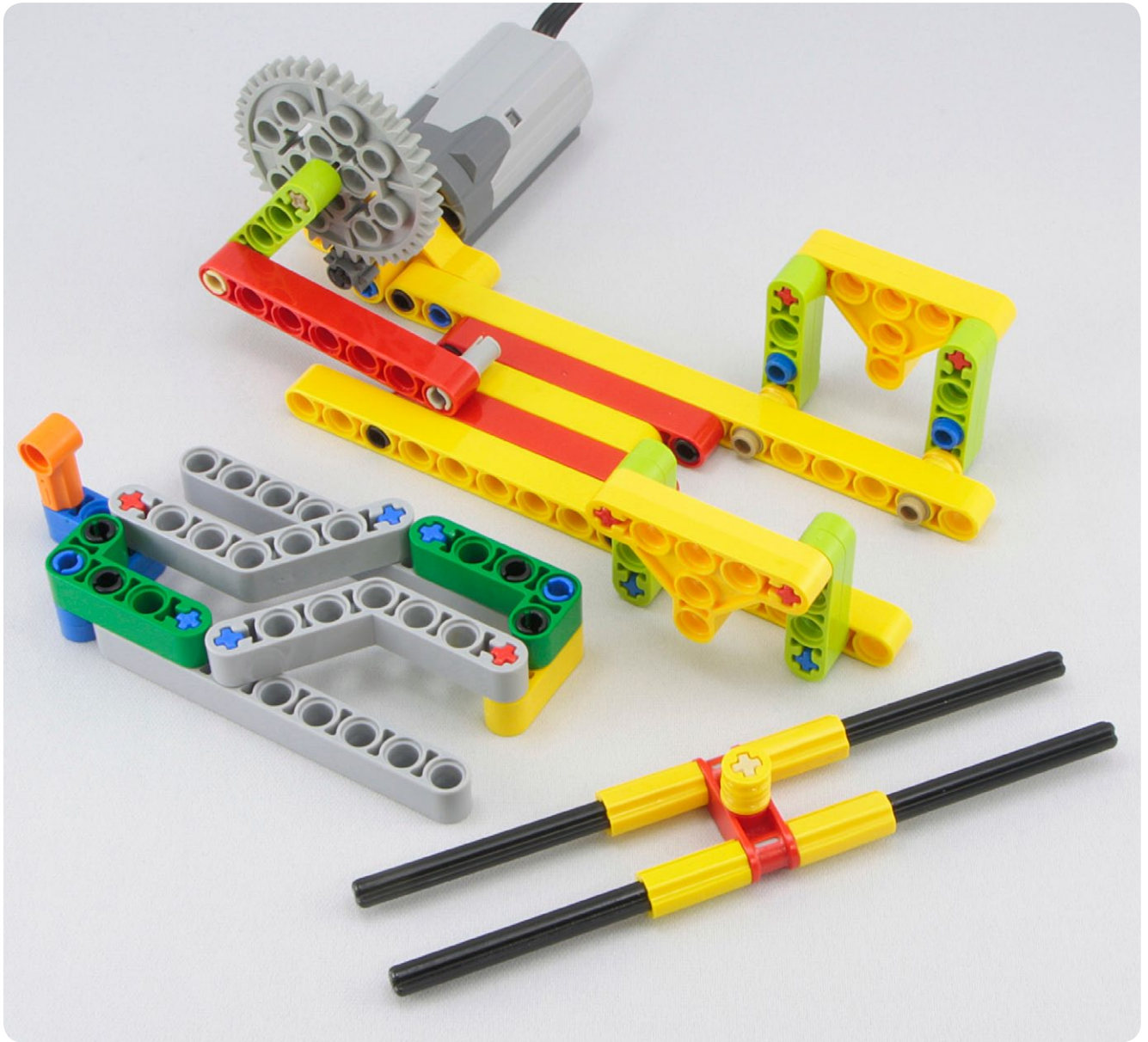


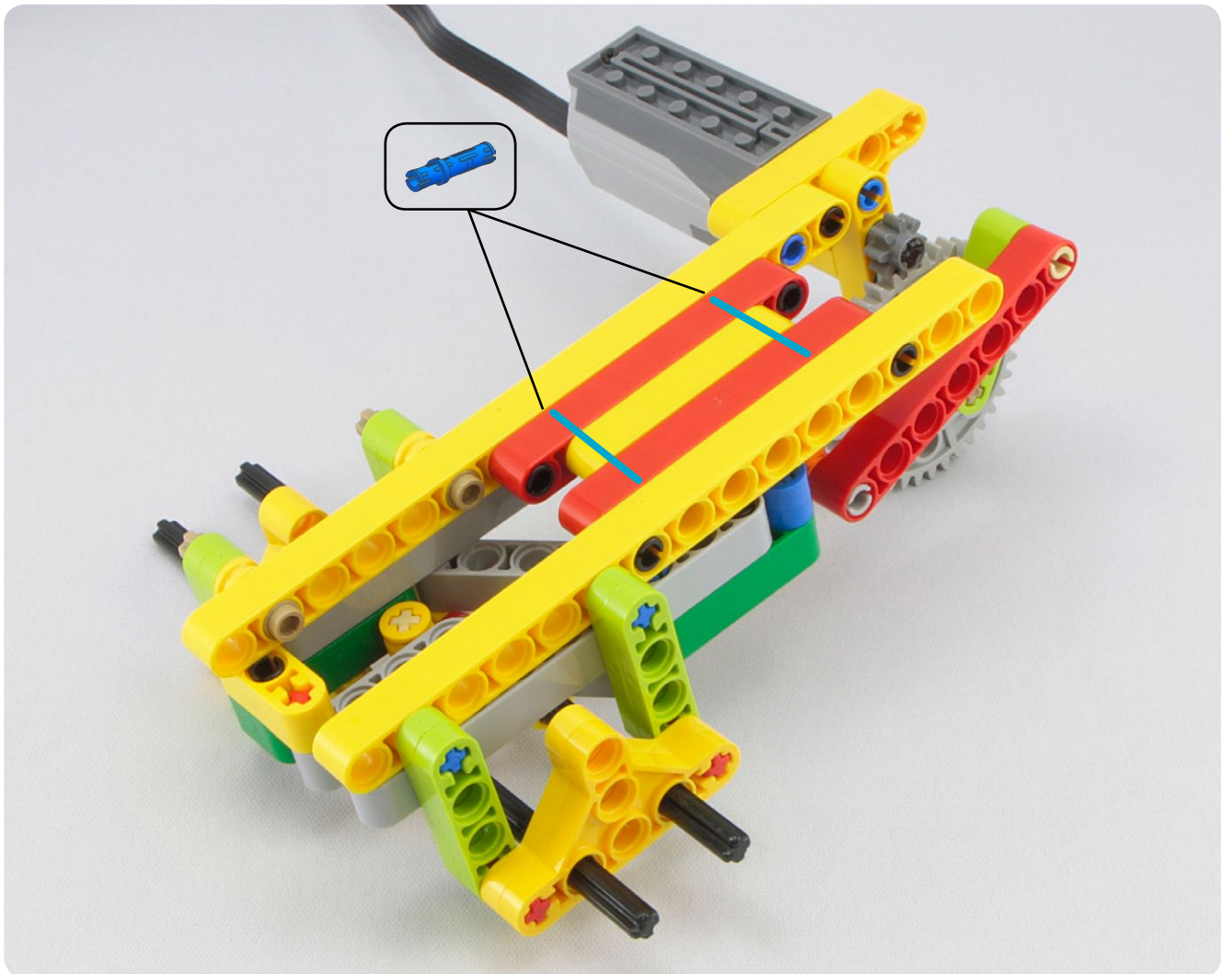
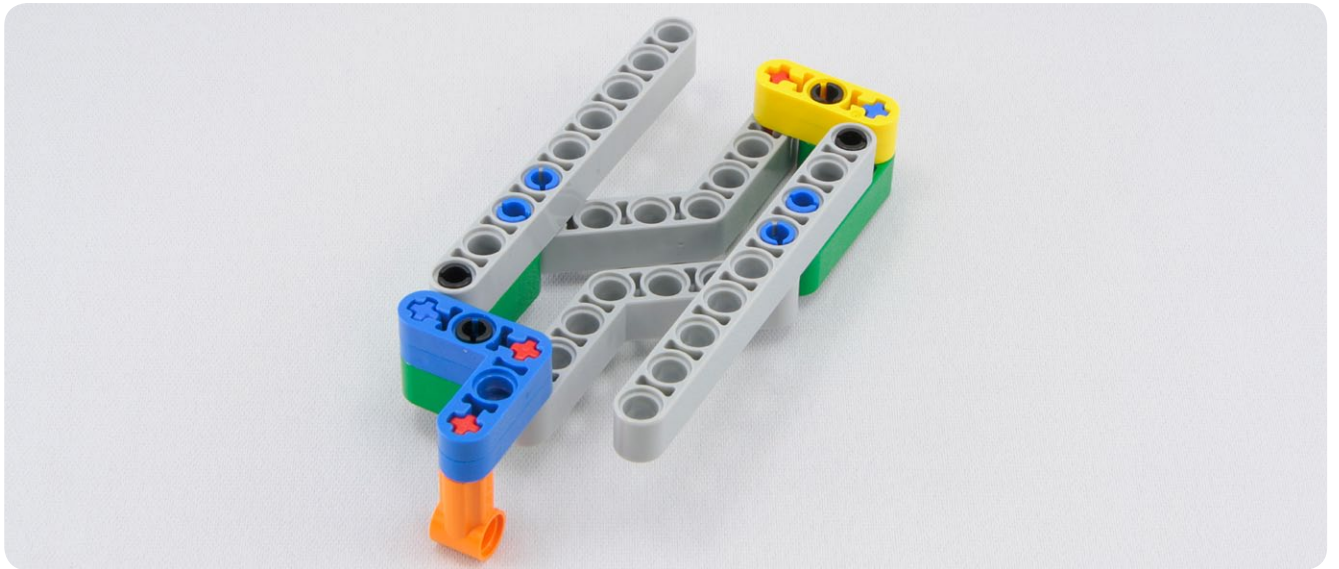


#189





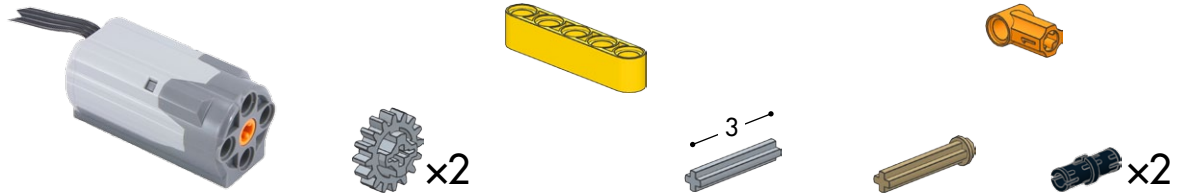




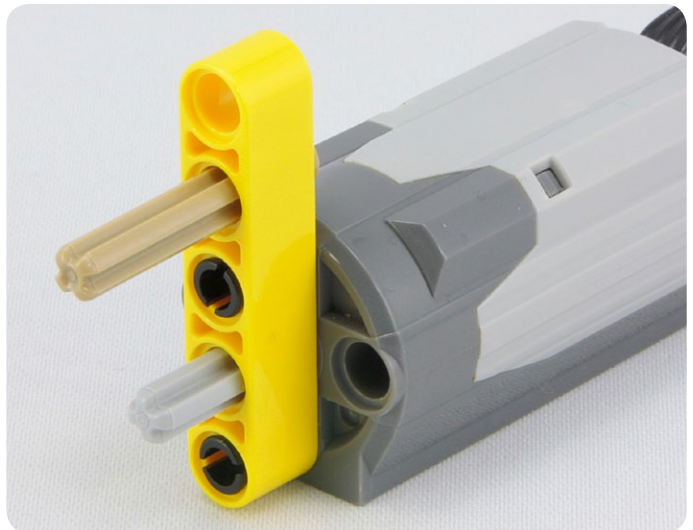
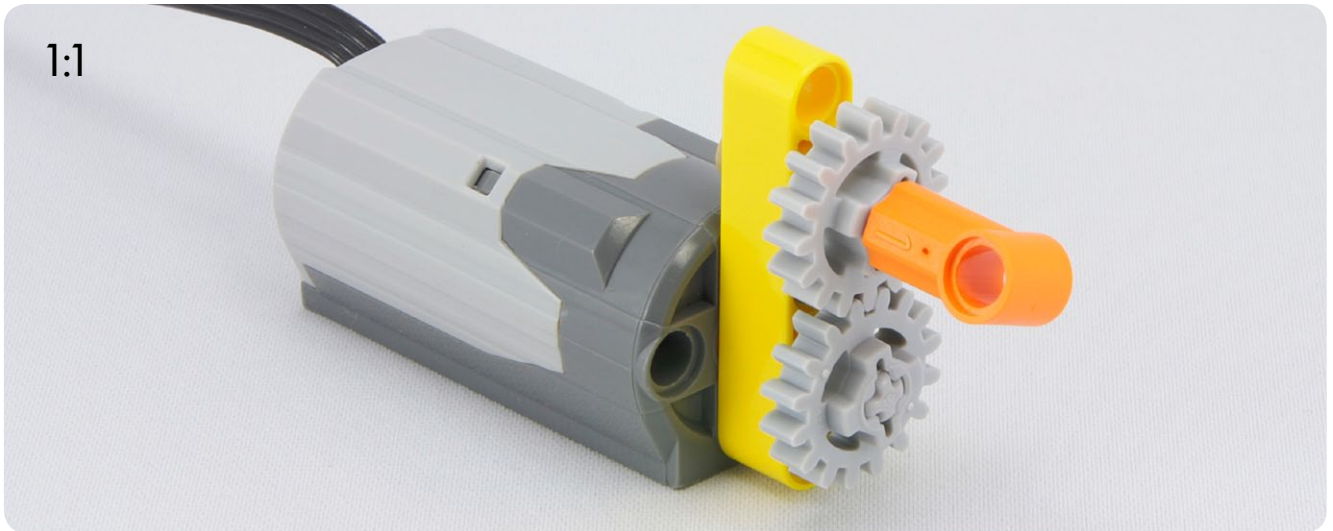
1:?

Gear systems with whole number ratios

#190



1:1

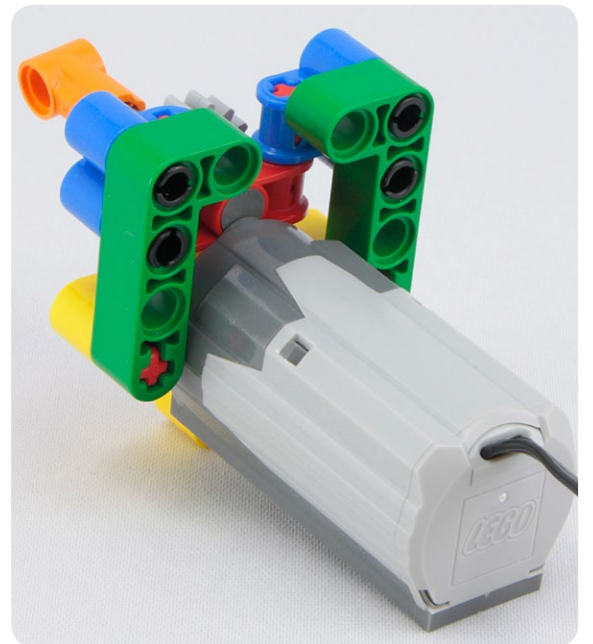


#191



LEGO parts list for step 191:

- 1 grey motor
- 1 grey gear
- 1 grey connector
- 2 green 1x3 Technic bricks
- 1 orange 1x2 Technic connector
- 1 red 1x3 Technic brick
- 2 yellow 1x5 Technic connectors
- 4 red 1x2 Technic connectors
- 2 blue 3-way Technic connectors
- 1 grey 1x3 Technic beam
- 1 grey 1x4 Technic beam
- 6 black 1x2 Technic pins



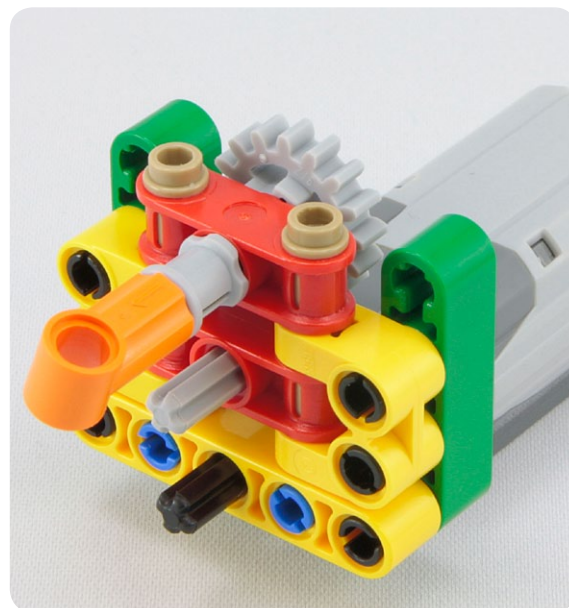
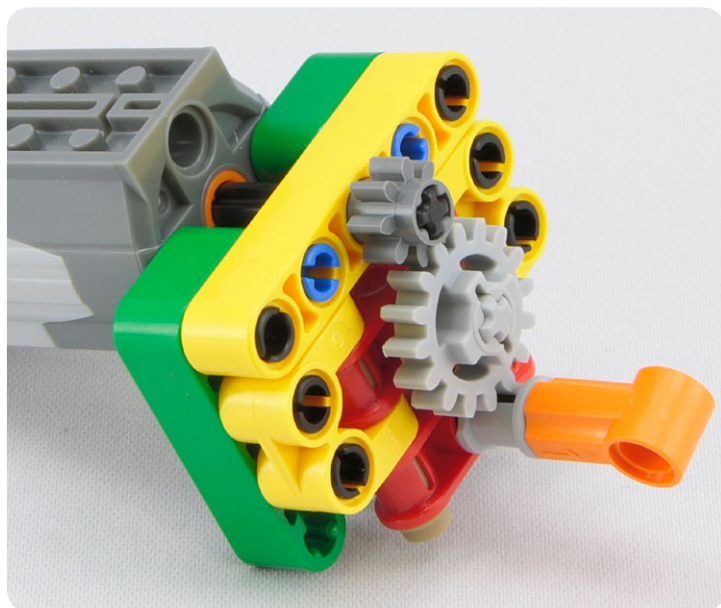
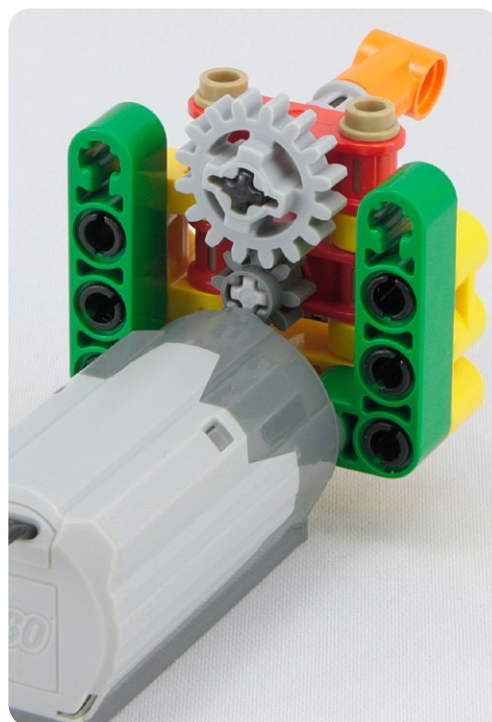
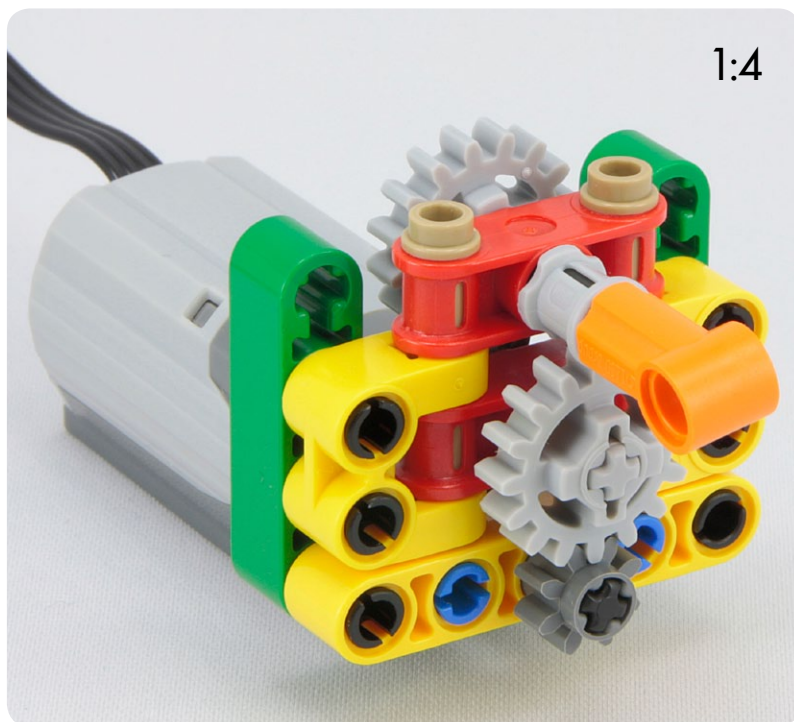
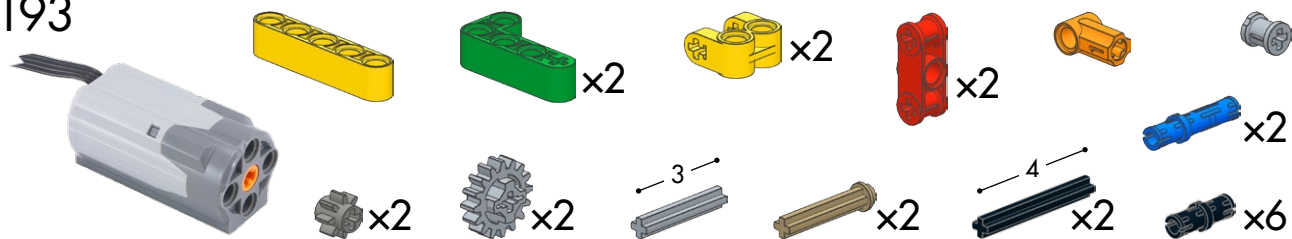
#192

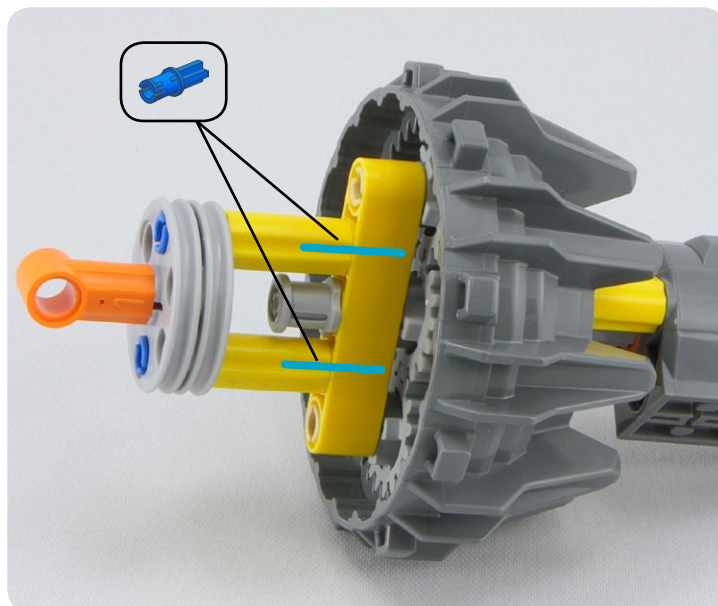
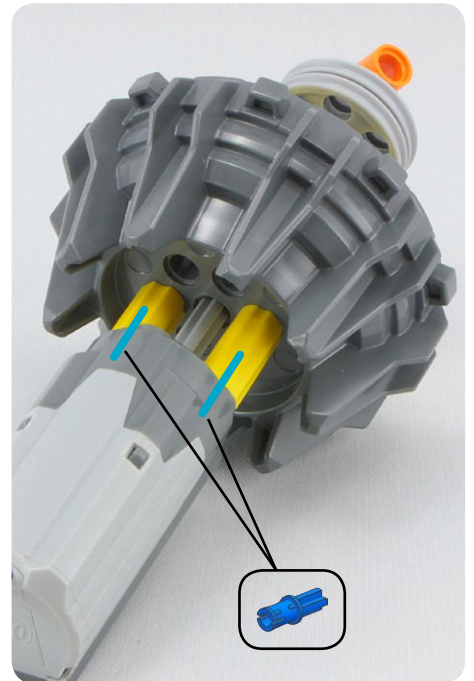


This image shows the parts list for step 192. It includes a grey motor, a grey gear, a yellow 1x5 Technic beam, a small grey cross-axle connector, a grey axle with a '3' indicating three pins to be inserted, an orange 1x2 Technic connector, a tan axle, and two black pins (indicated by 'x2').



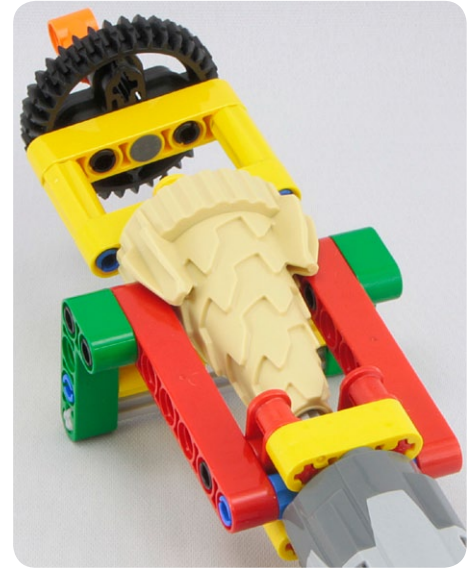
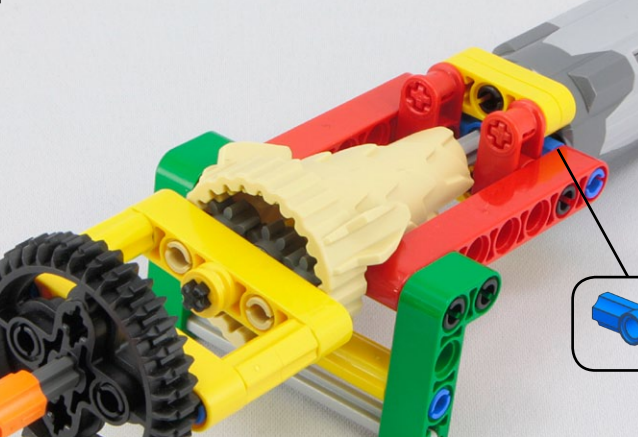
#193



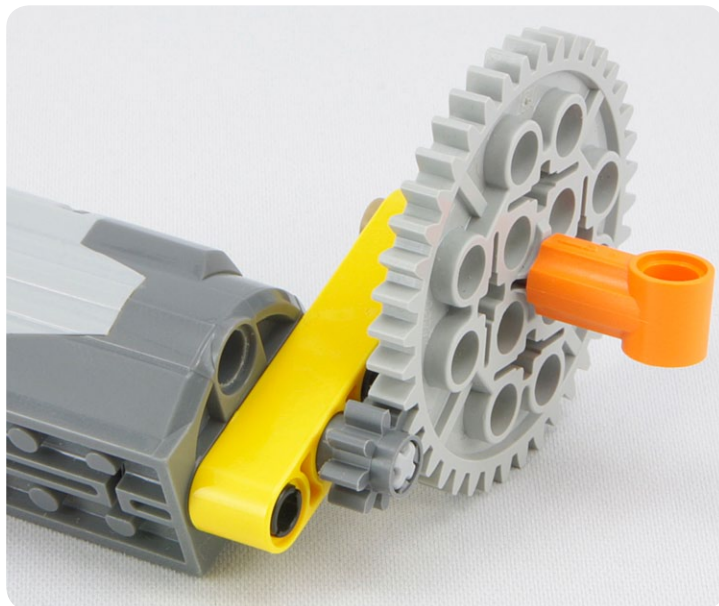
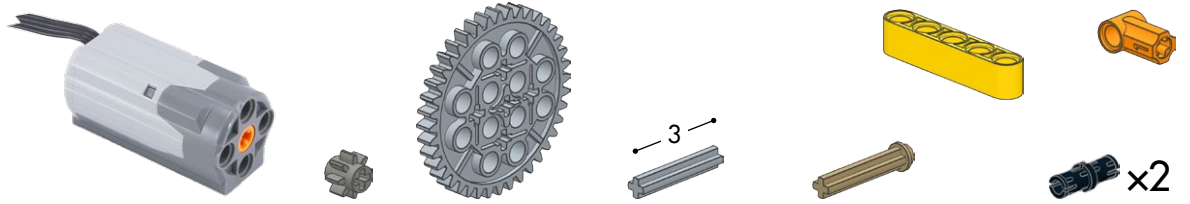
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[illegible]

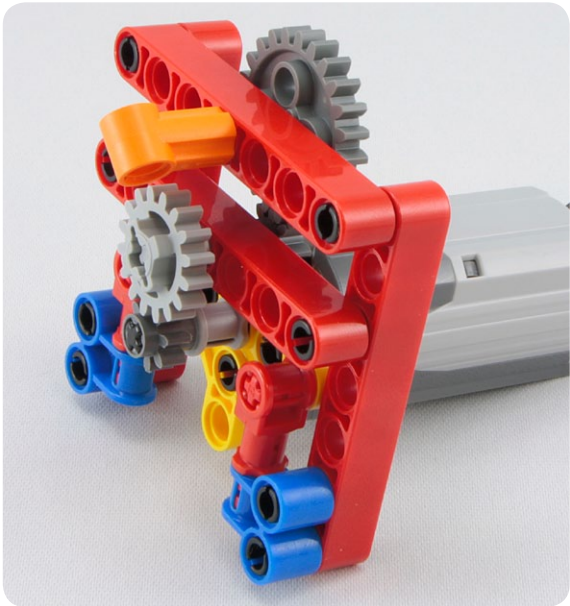
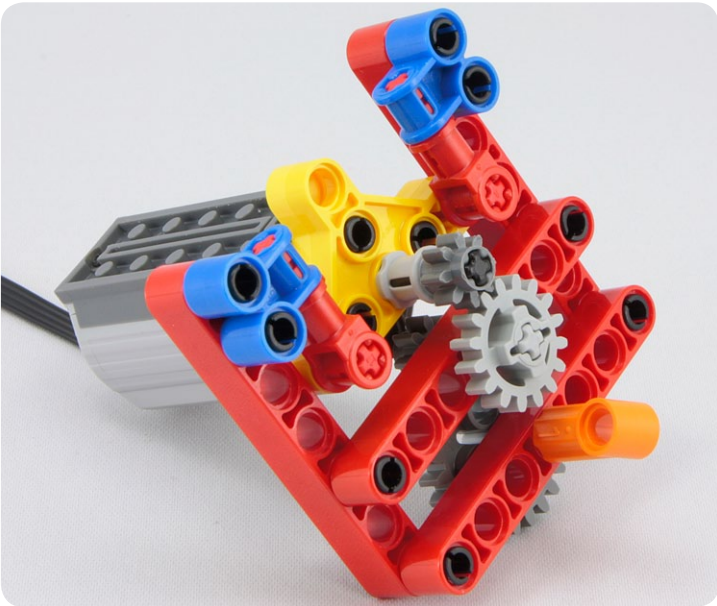
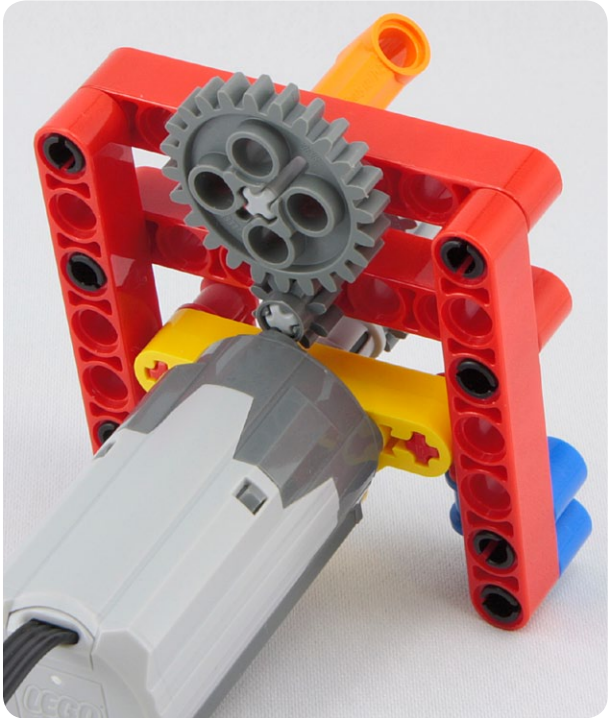
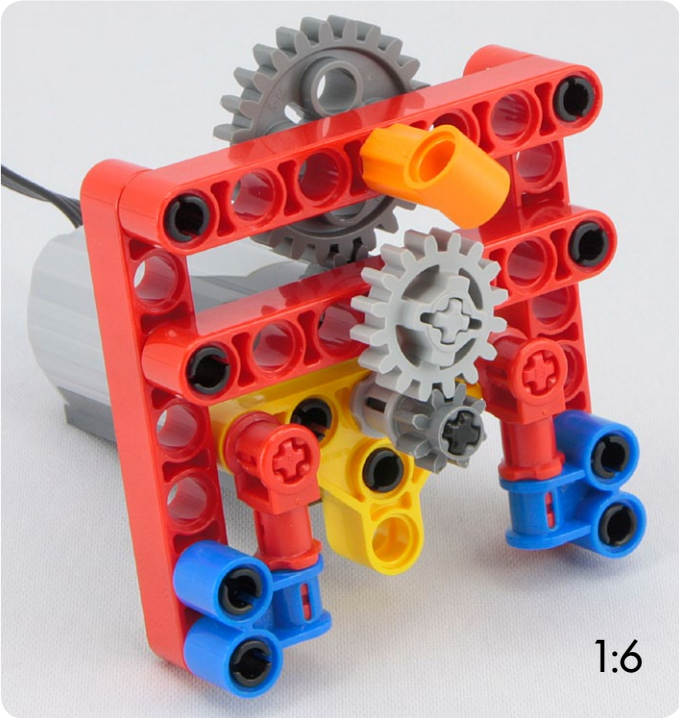
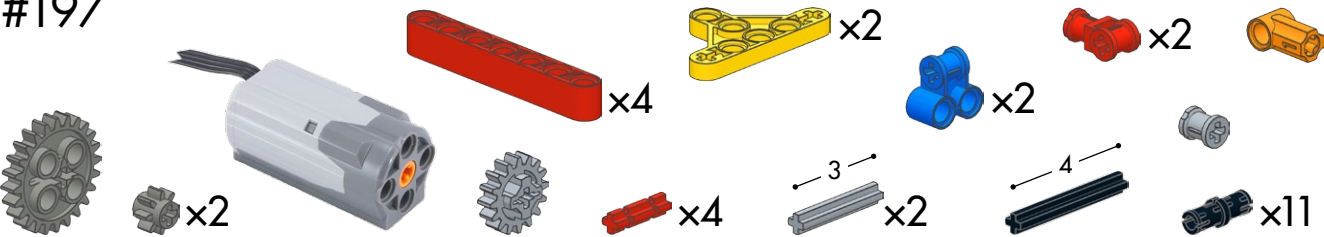
1:4



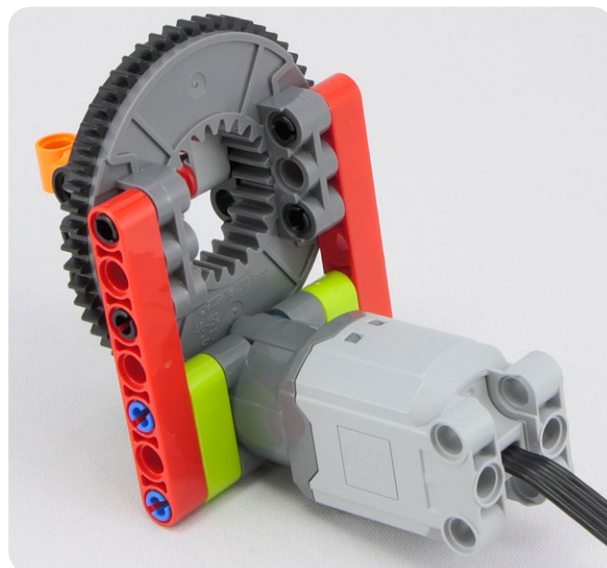
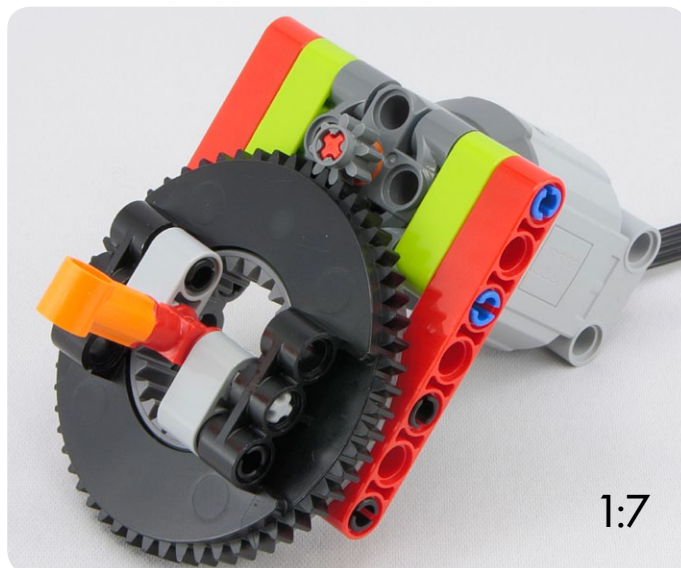
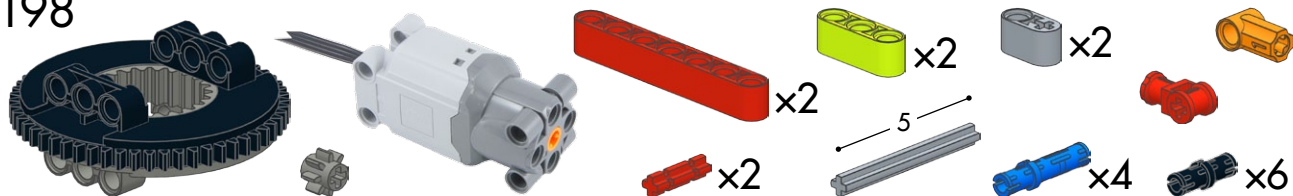
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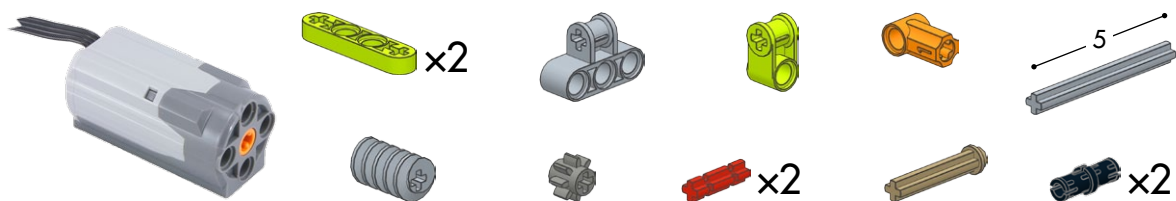
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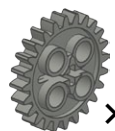
#198



#199



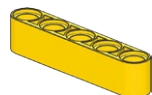
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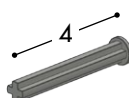
x2



x2



x2

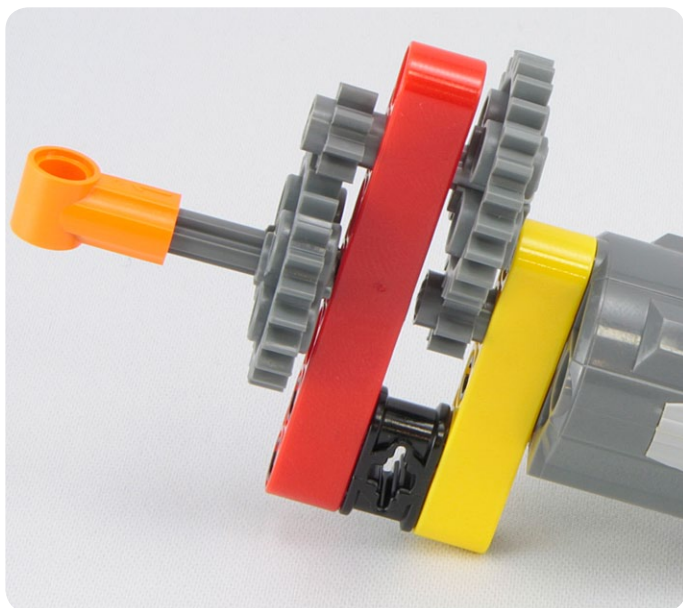
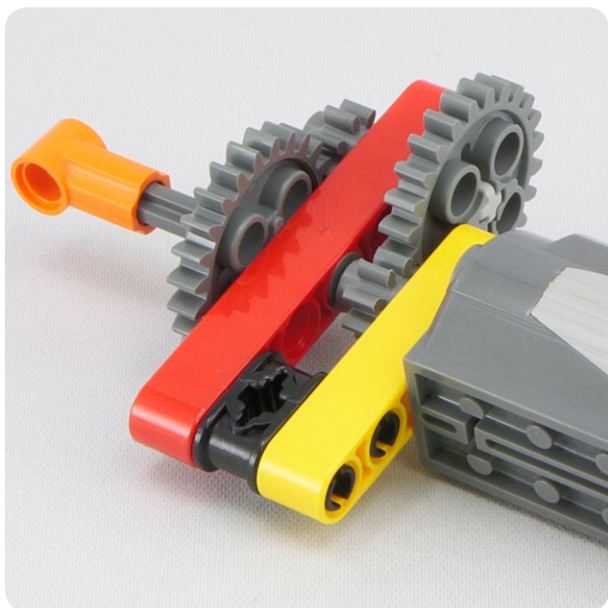
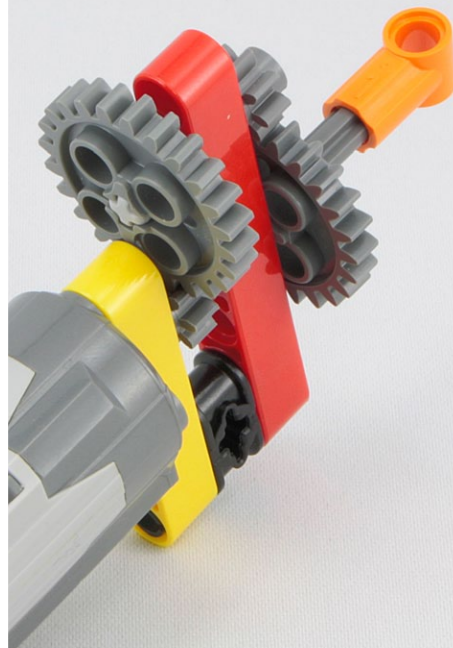
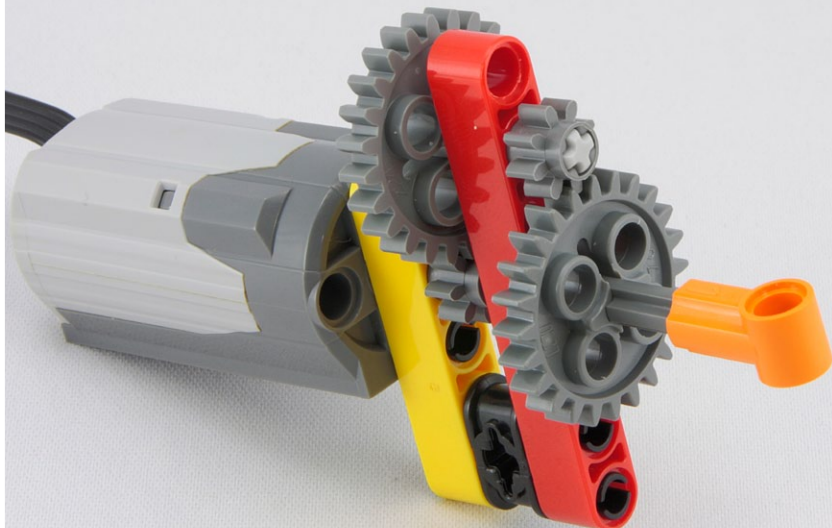


4

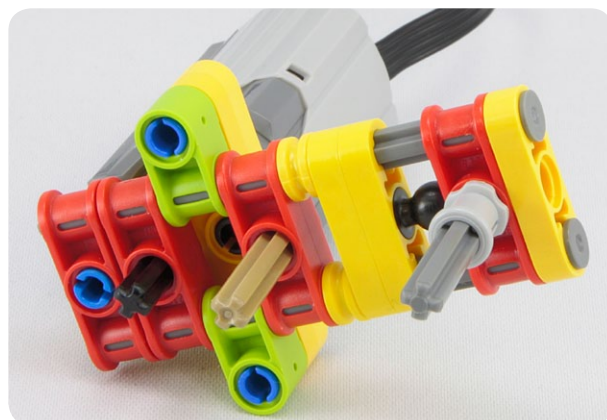
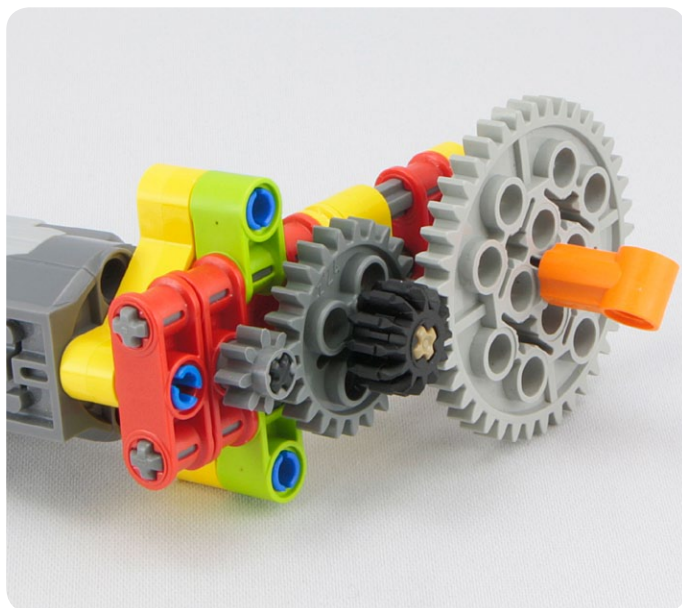
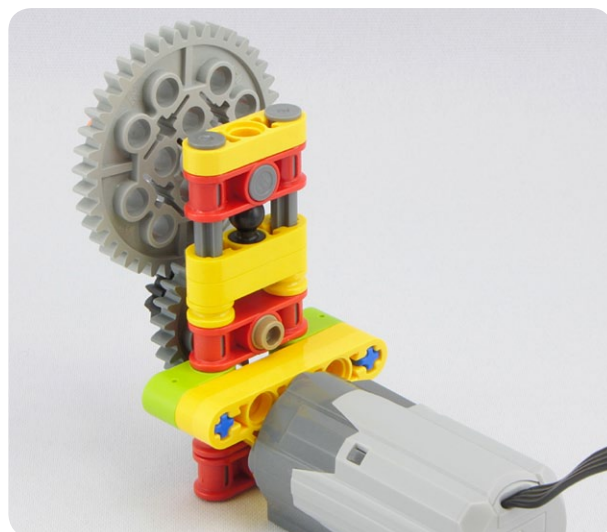
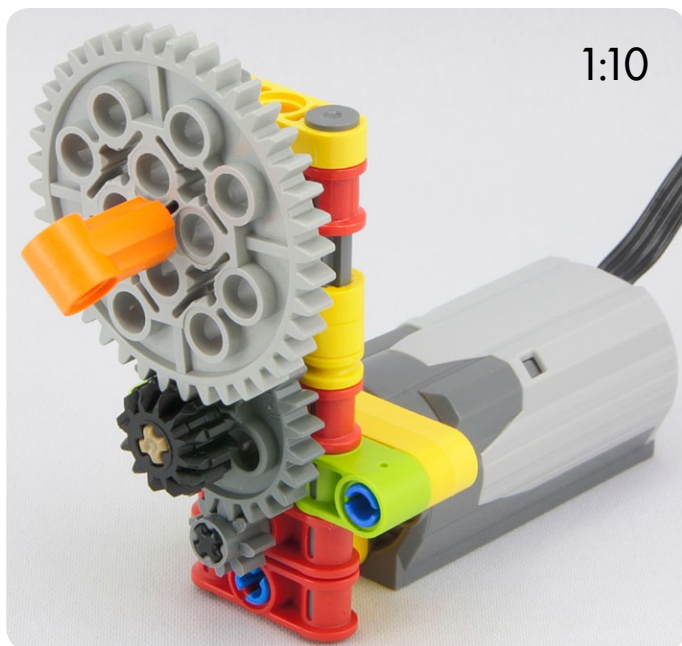
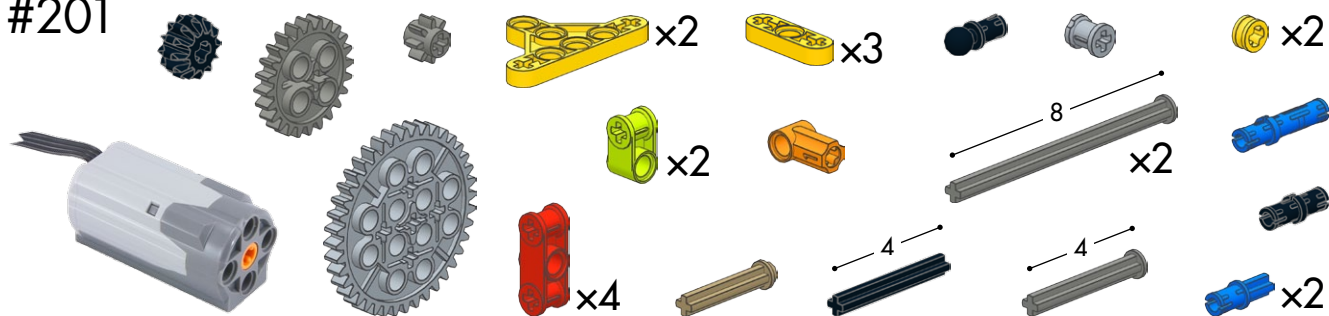


x2

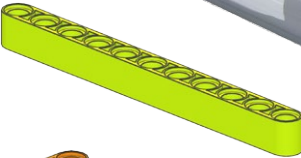
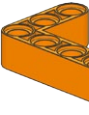
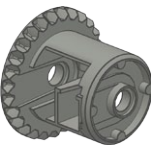
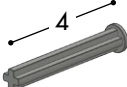
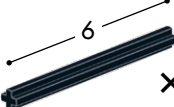
1:9



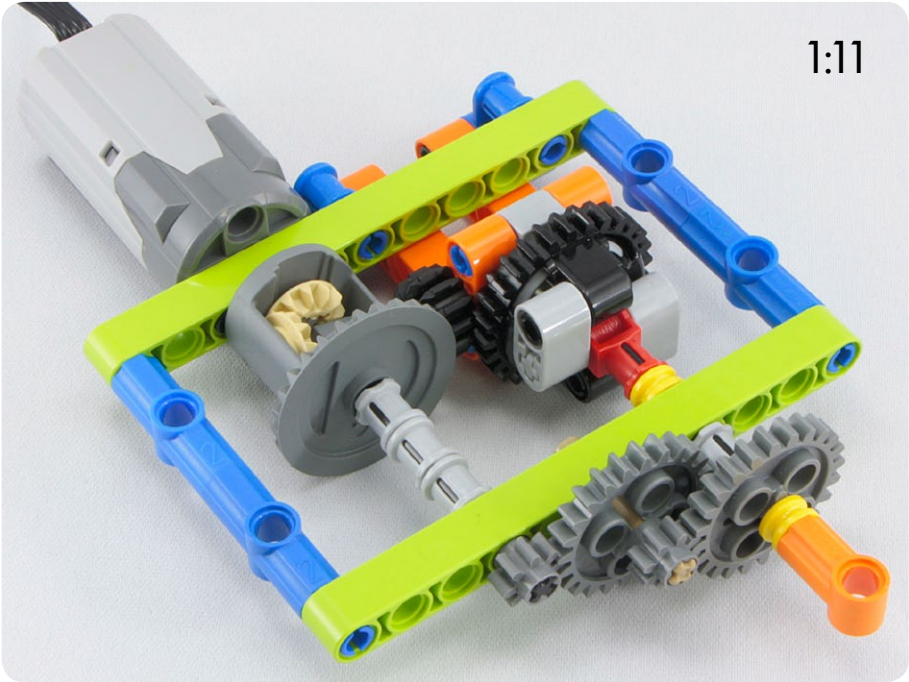
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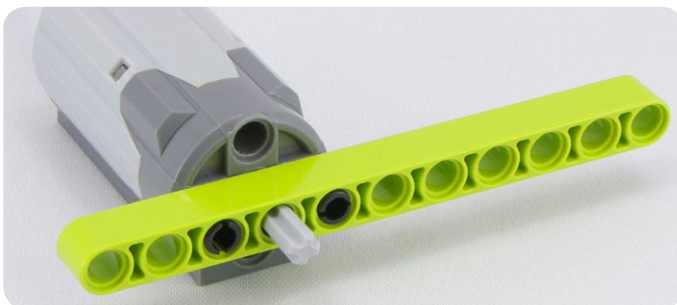
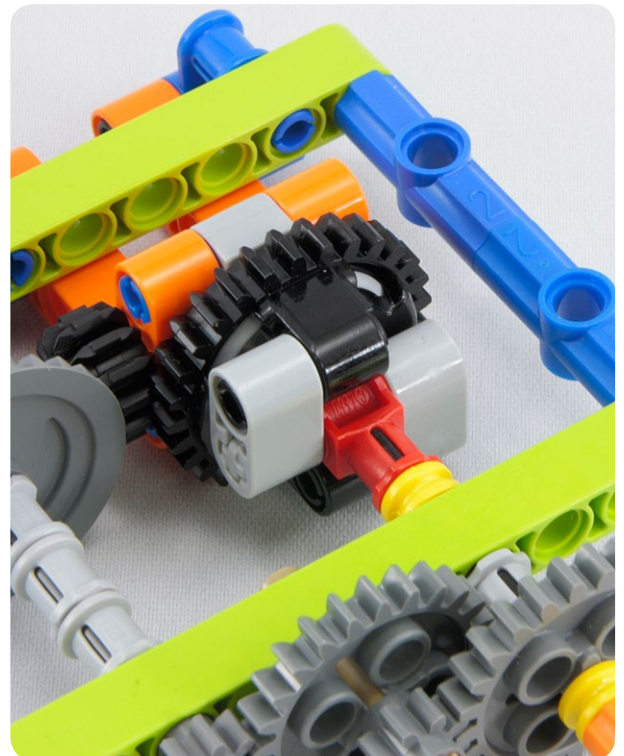
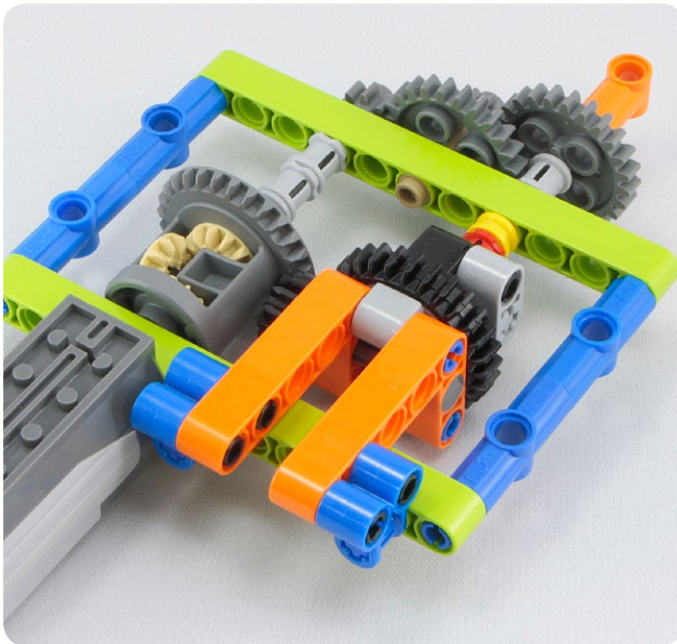
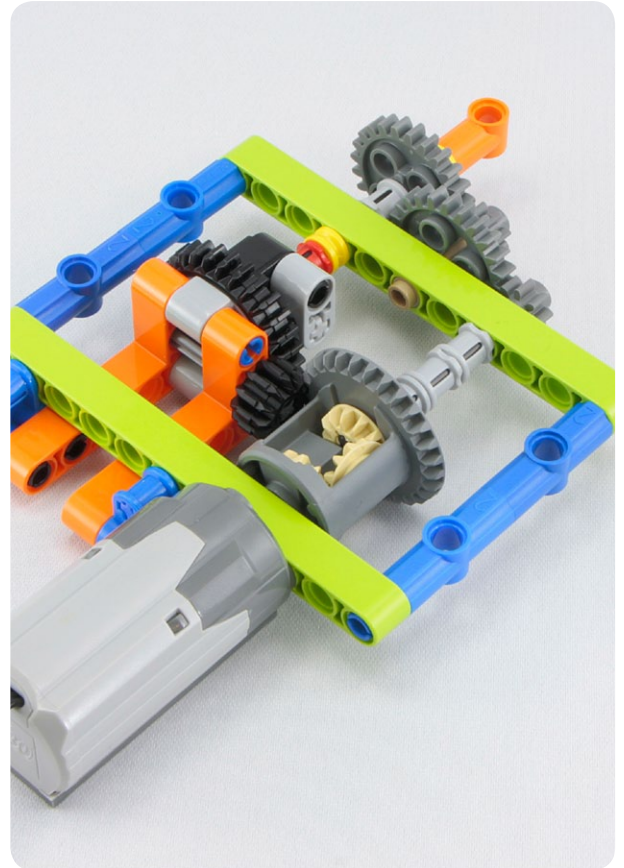
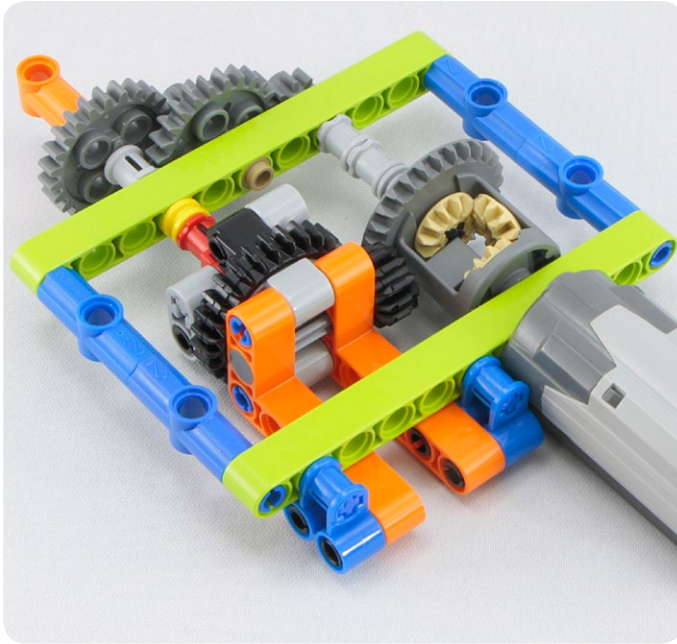


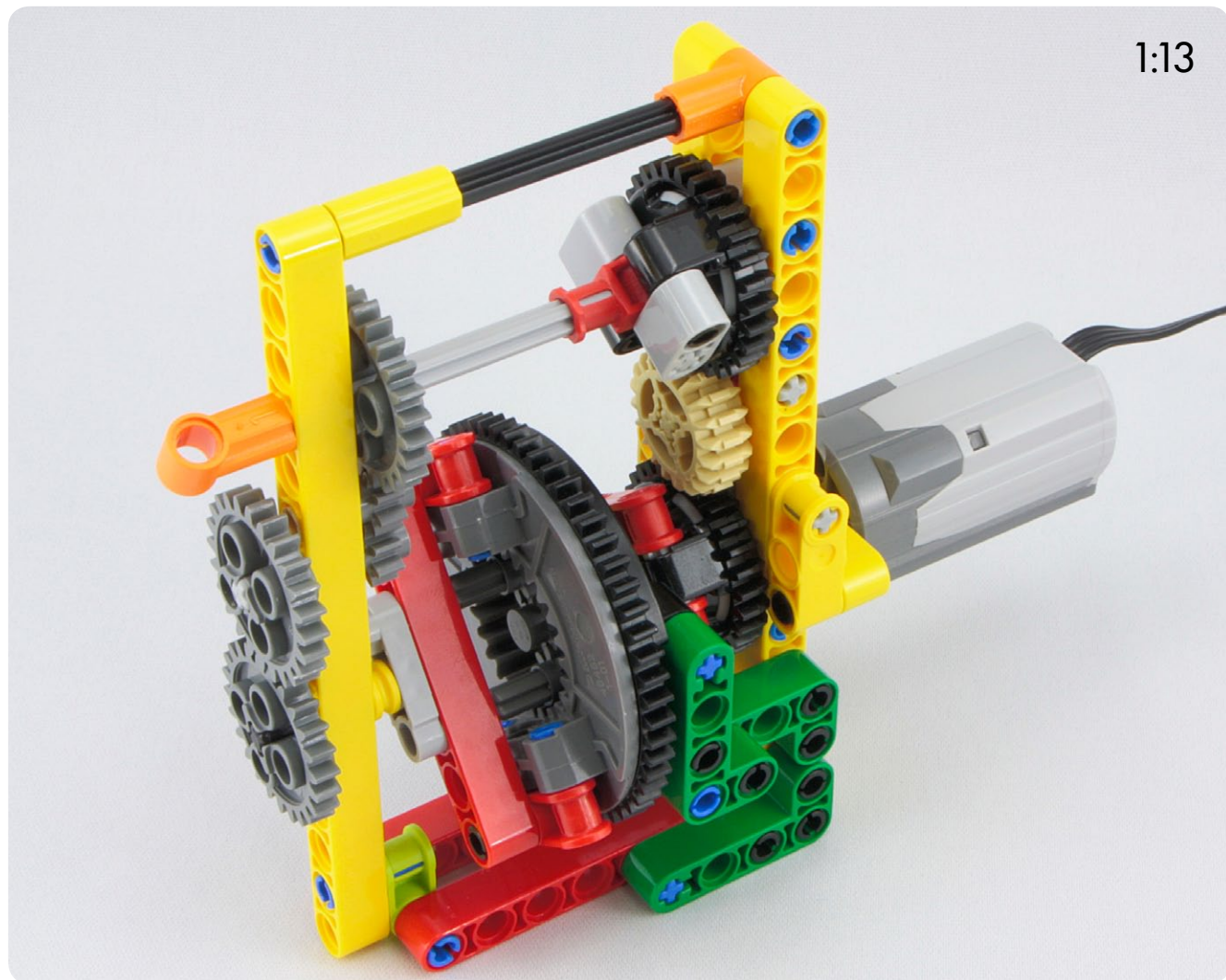
#202

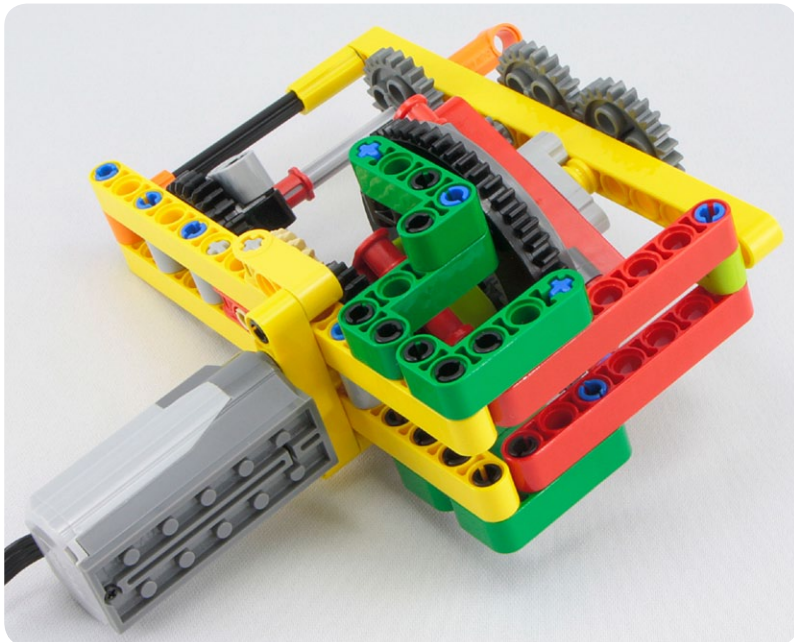
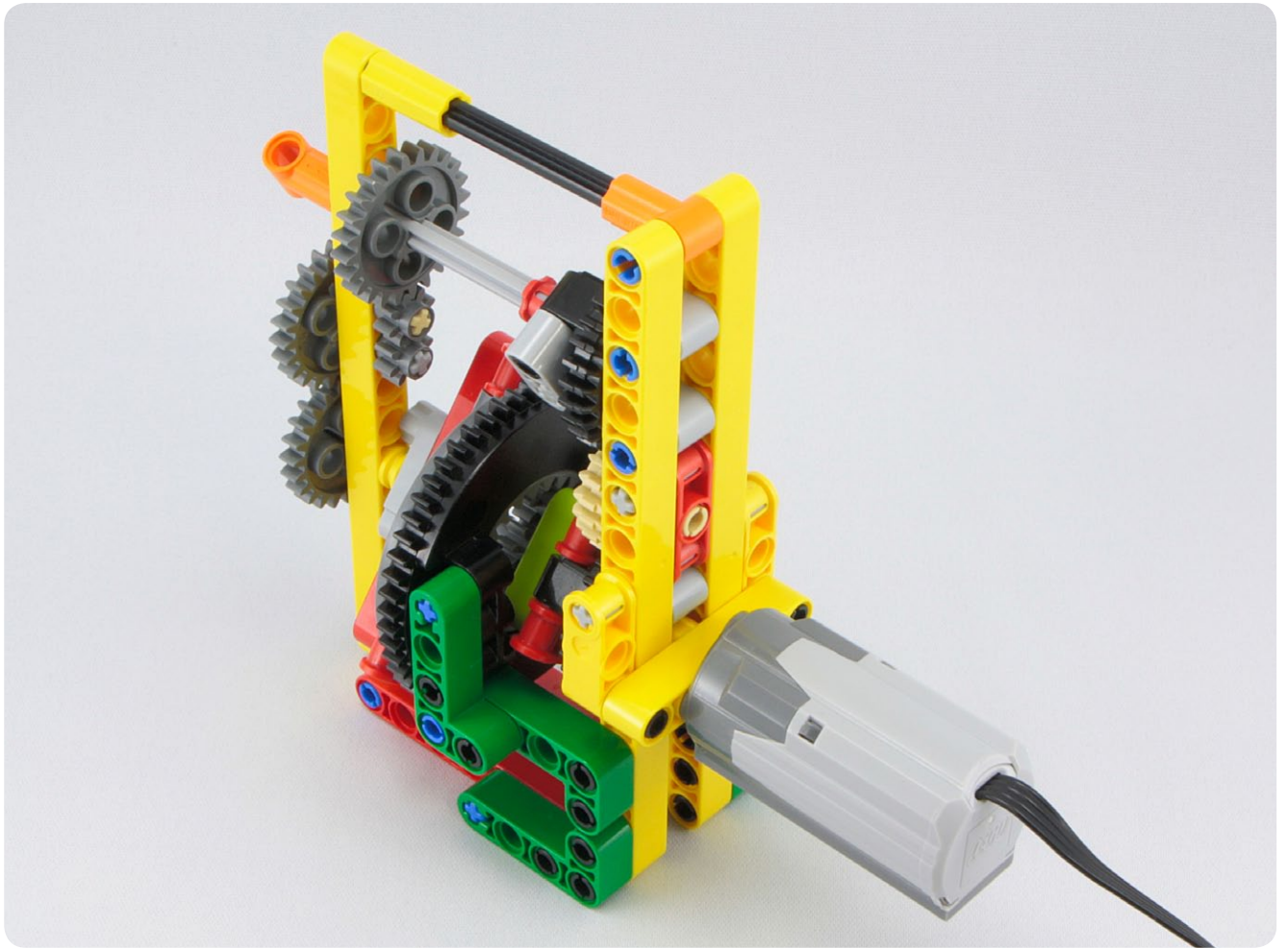
- 
-  x2
-  x2
- 
- 
-  x2
- 
-  x2
-  x2
-  x3
- 
-  x2
-  x4
- 
-  x2
- 
-  x2
-  x2
-  x2
- 
-  x2
-  x4
-  x2
-  x6
-  x2
-  x8

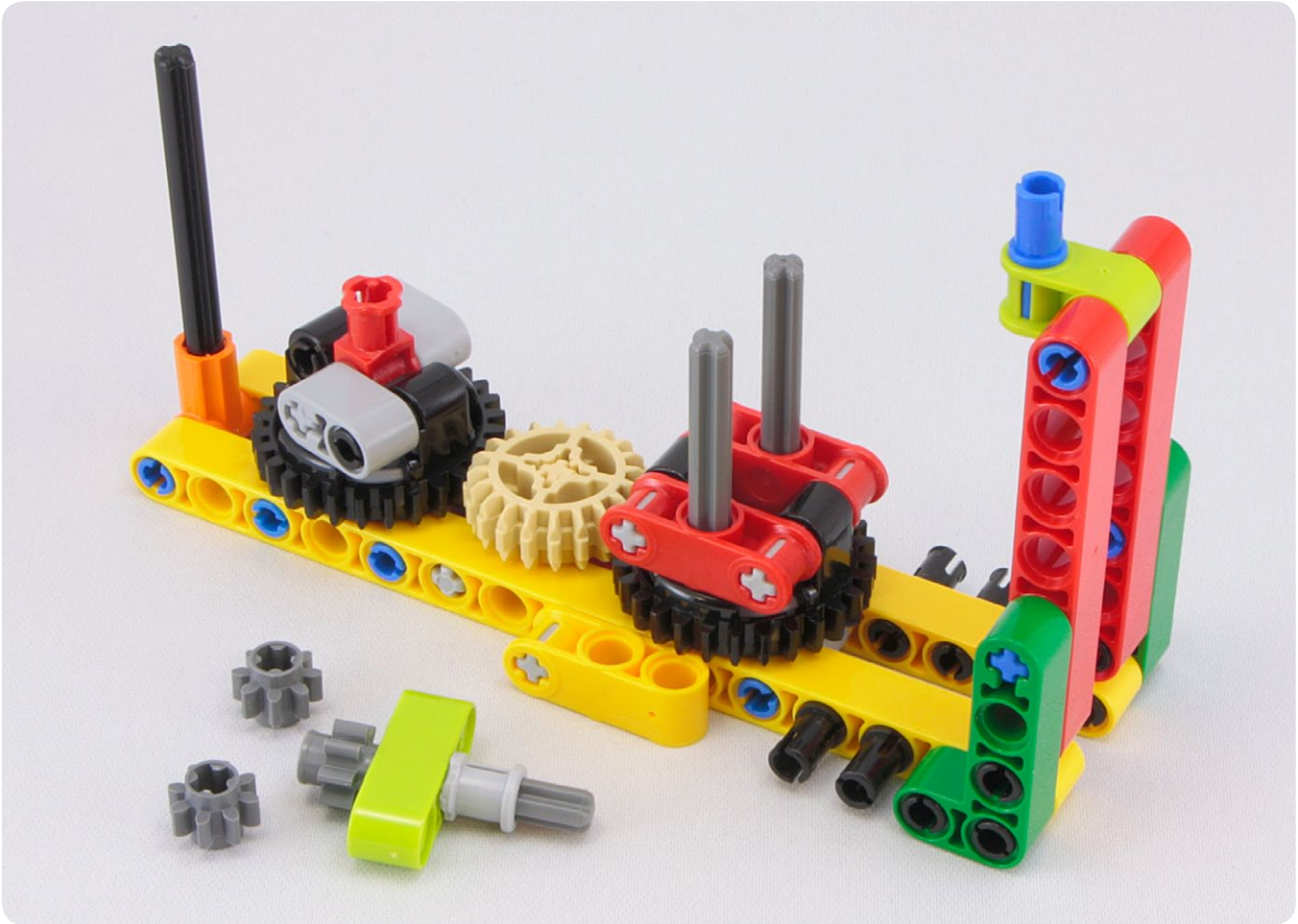
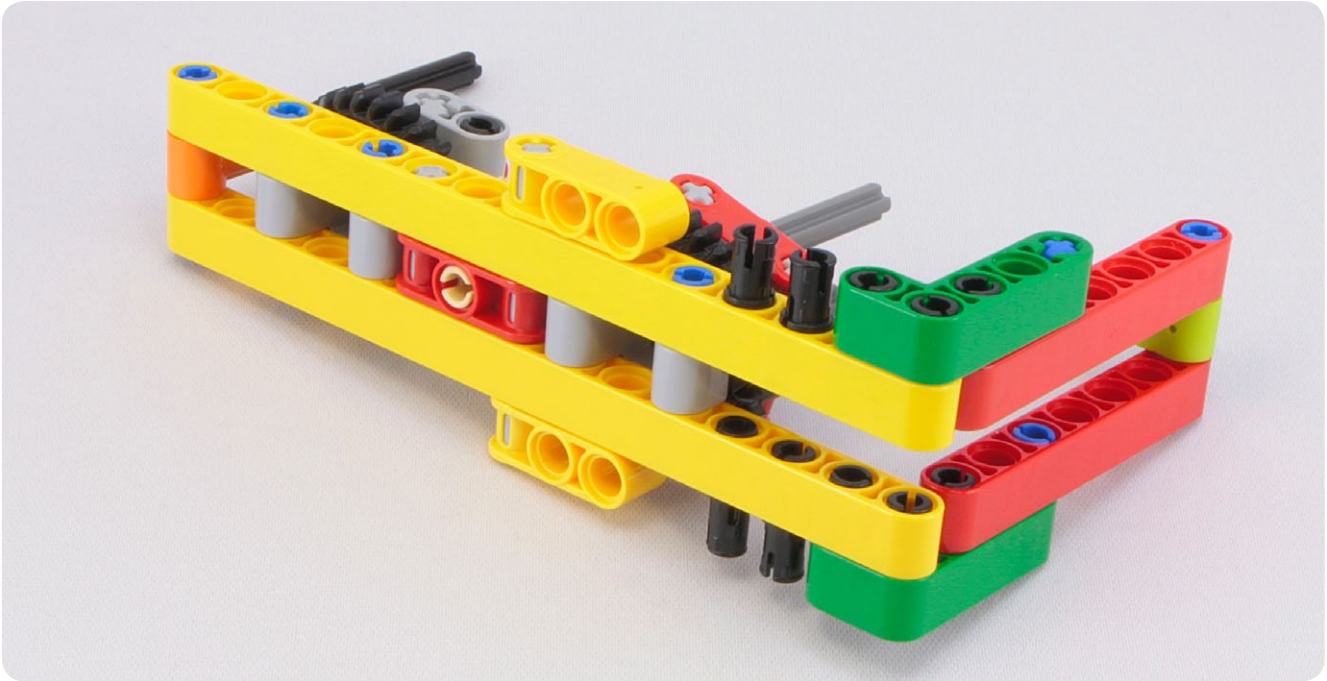
1:11

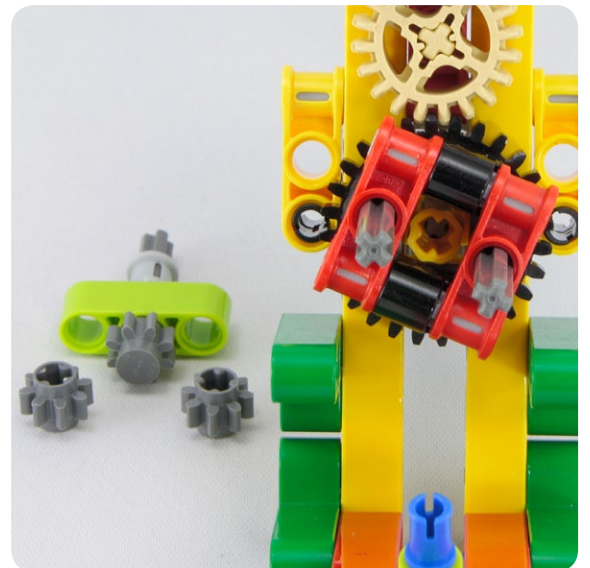
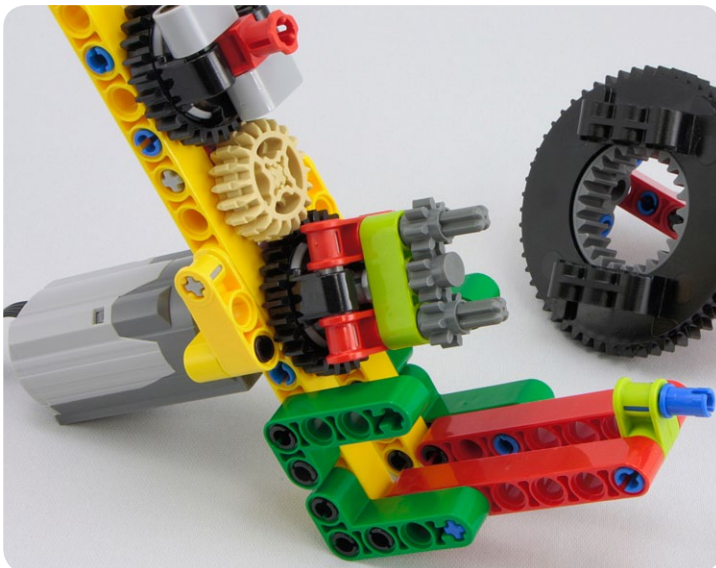
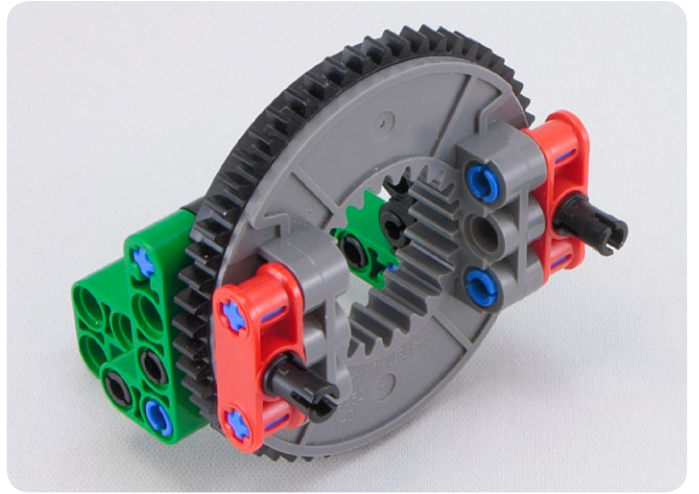


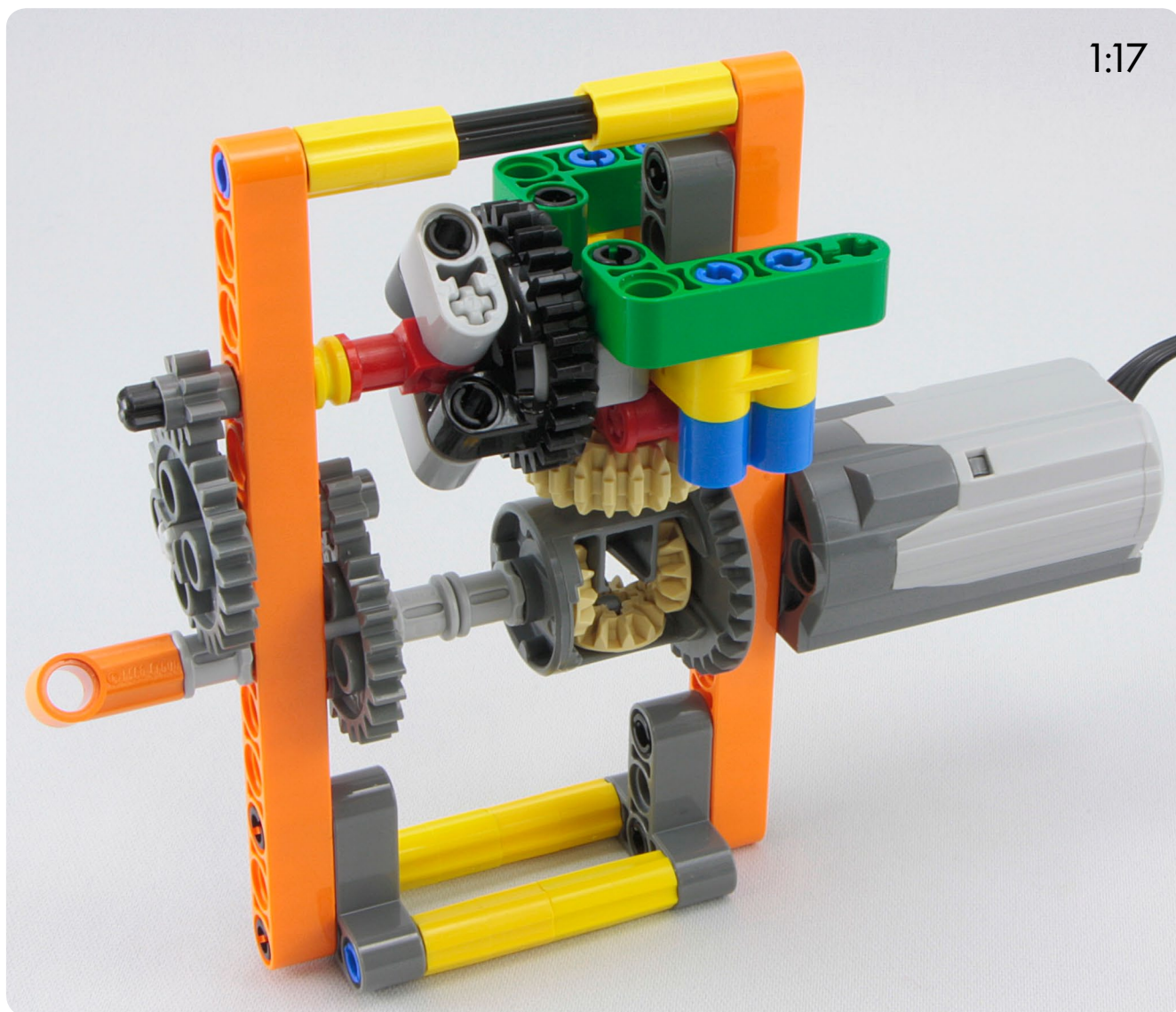


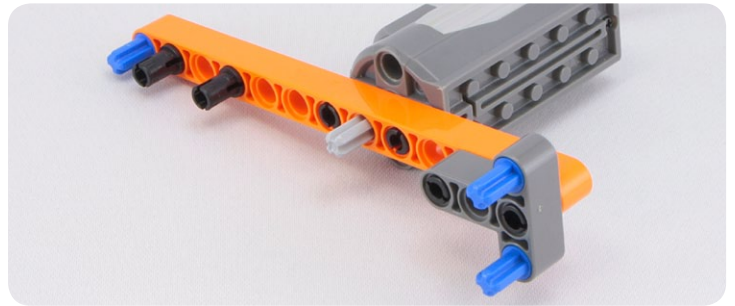
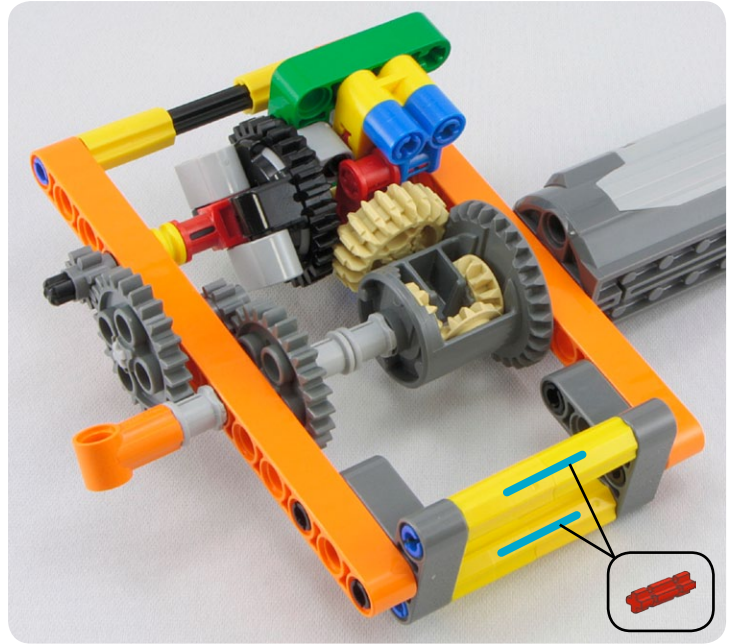
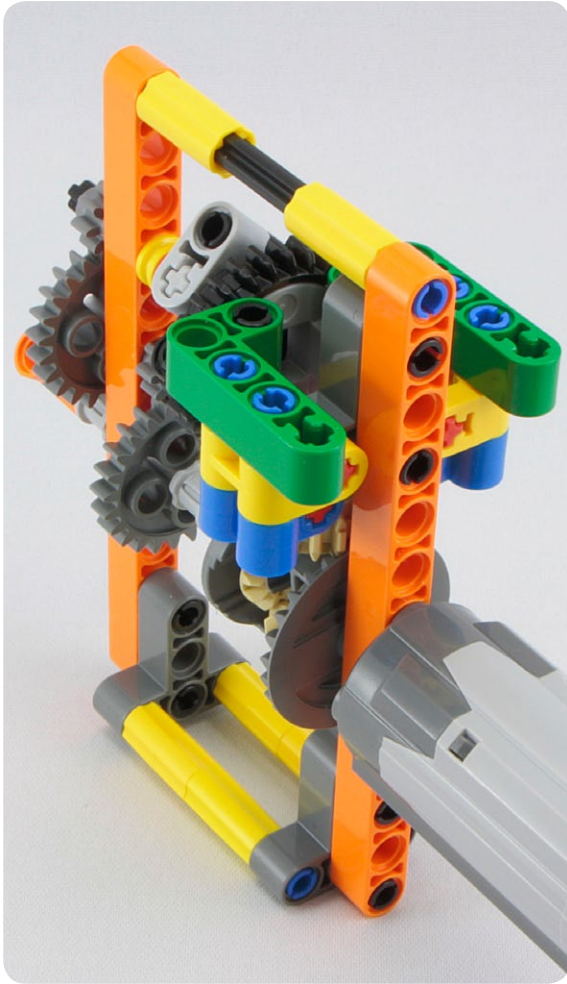
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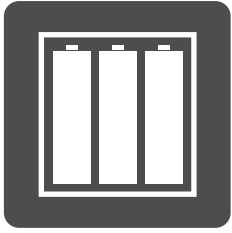






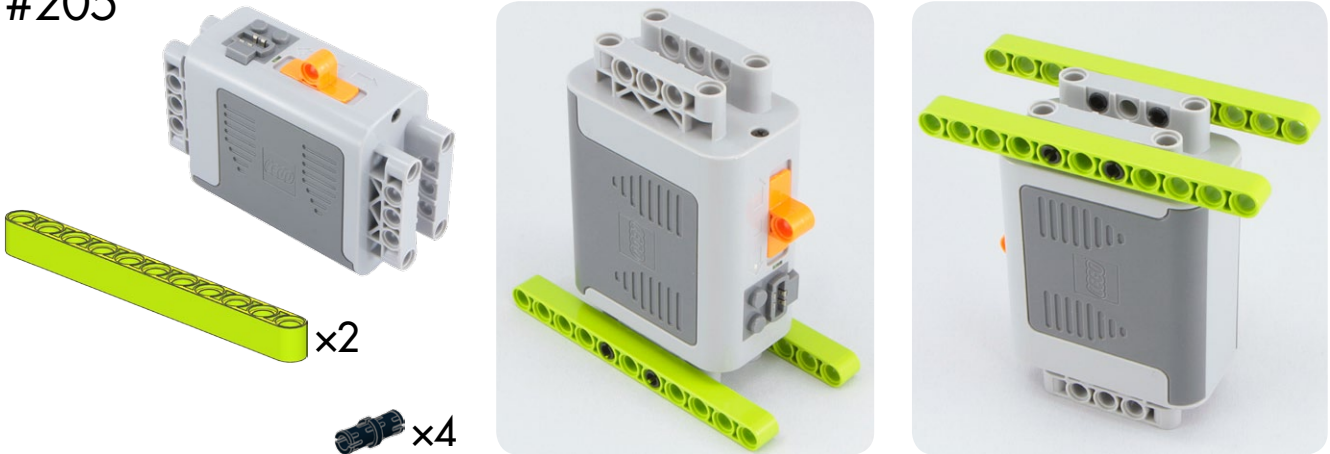
[illegible]



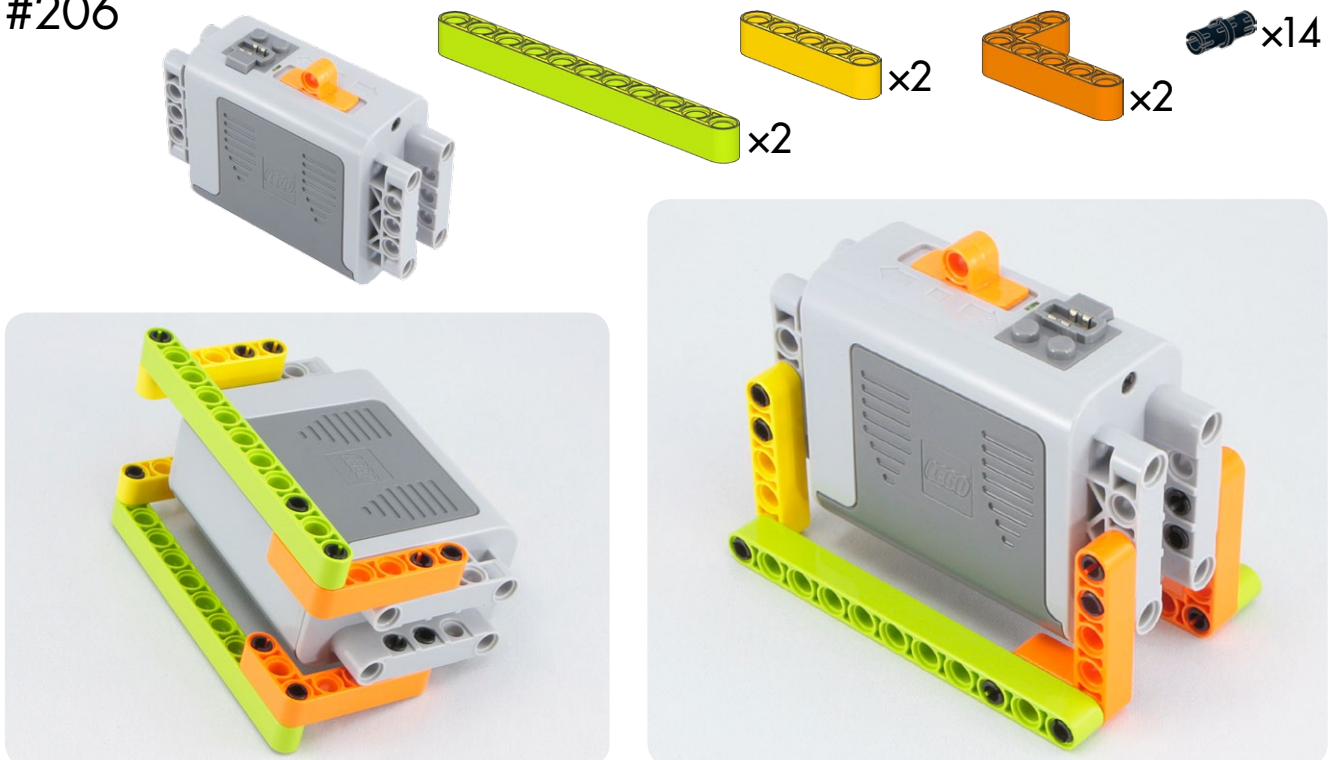


Attaching a battery box

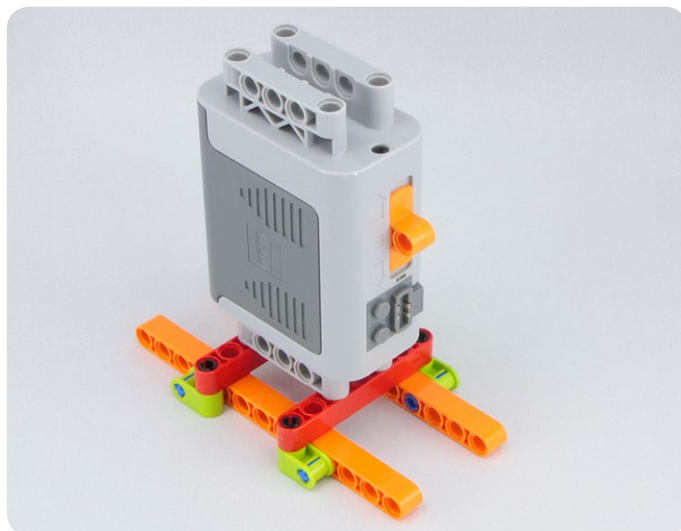
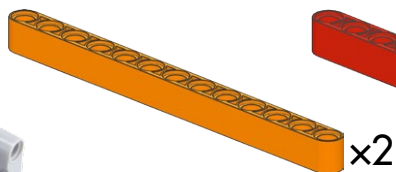
#205



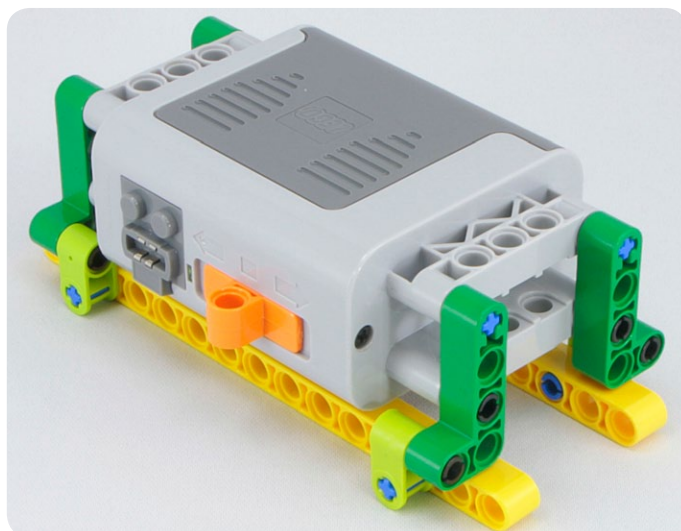
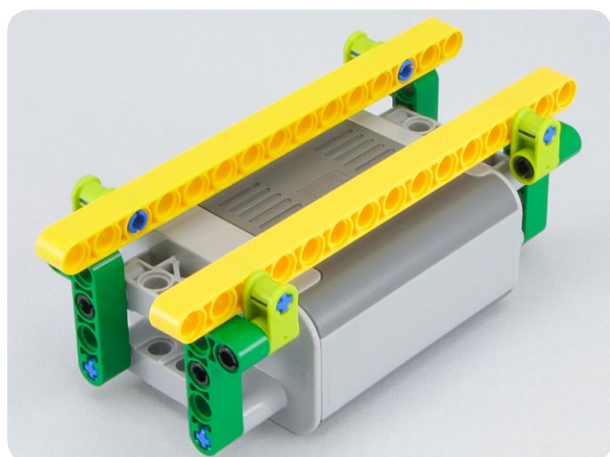
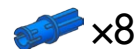
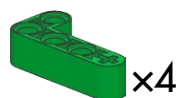
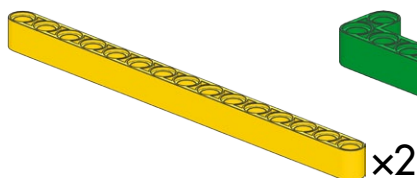
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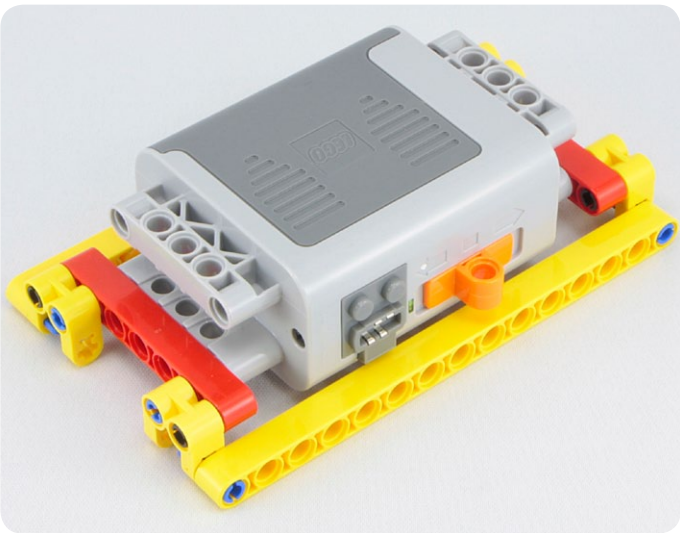
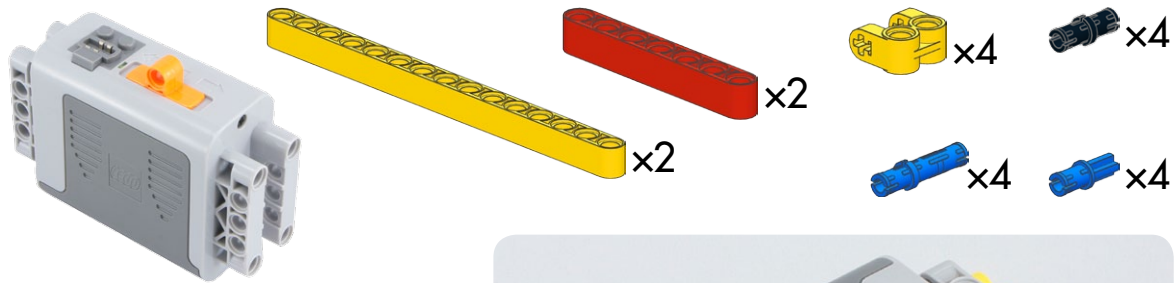
#207



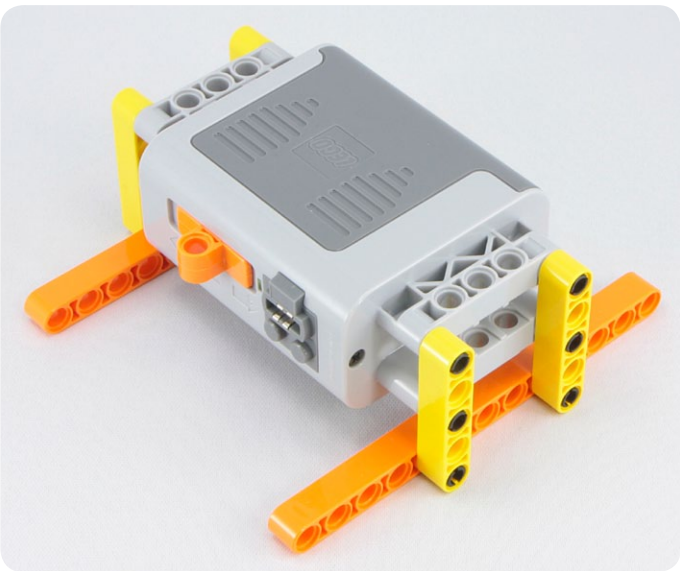
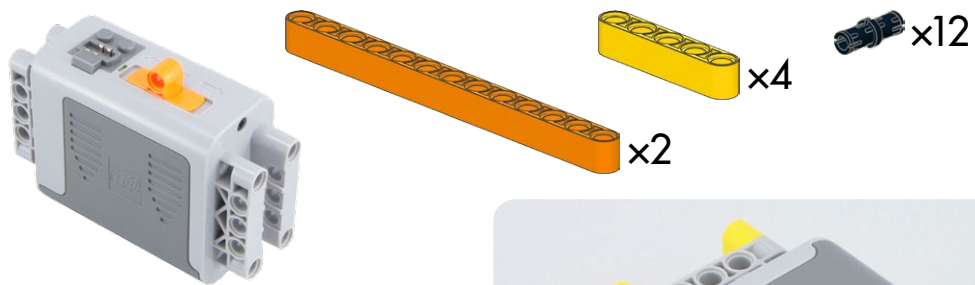
#208



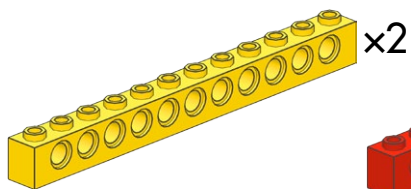
#209



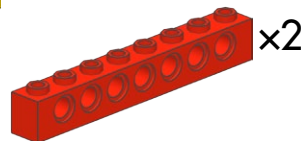
#210



#211



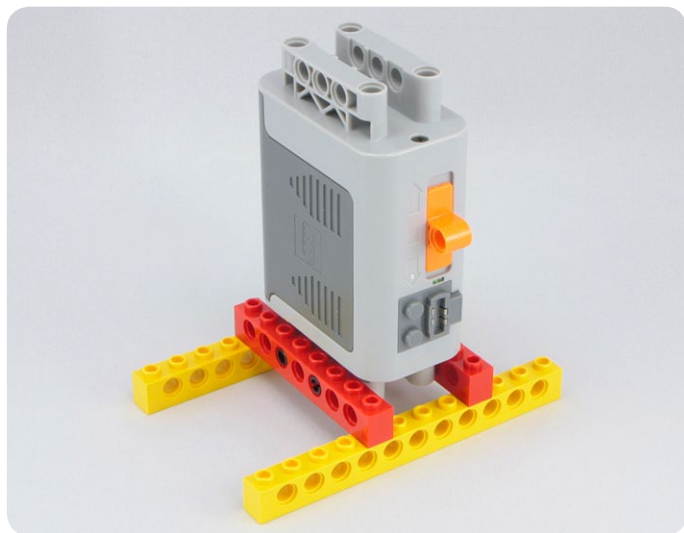
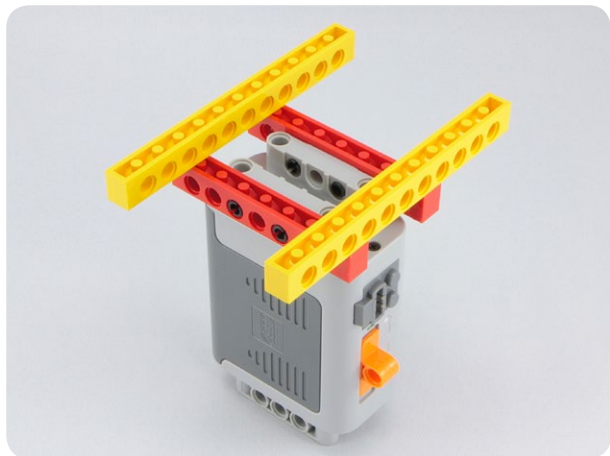
x2



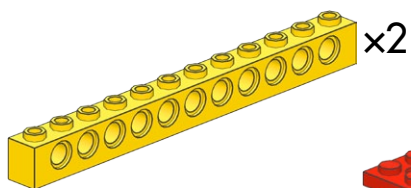
x2



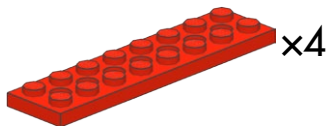
x4



#212



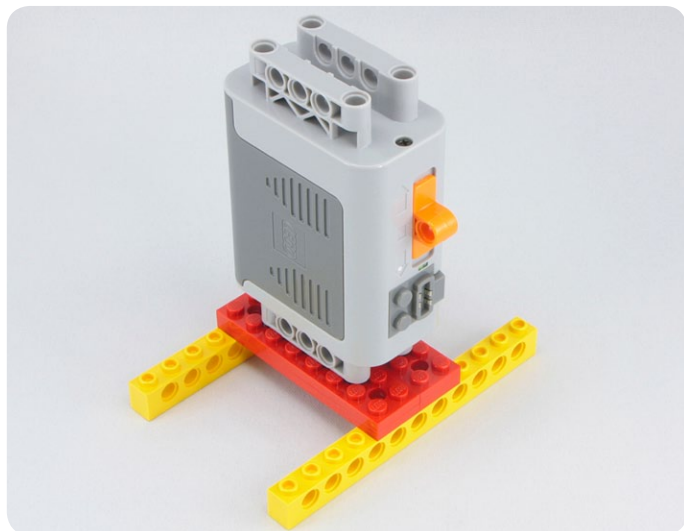
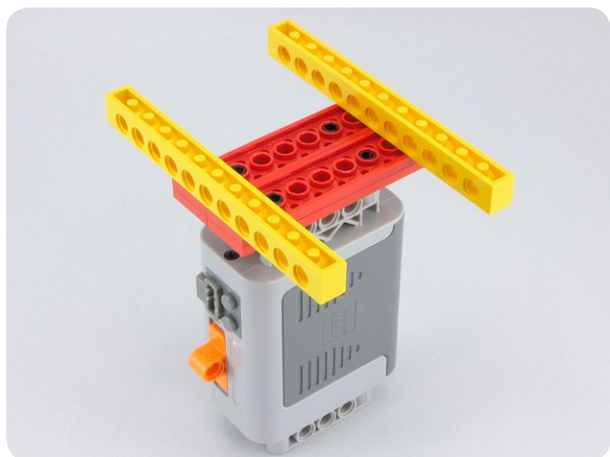
x2



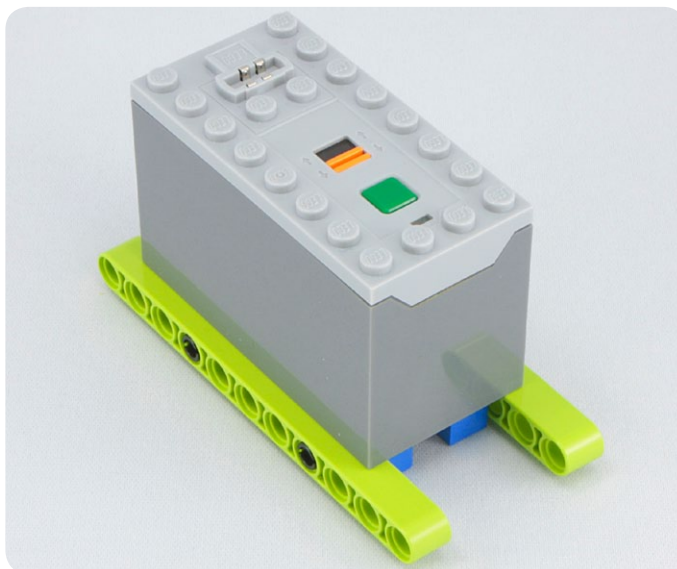
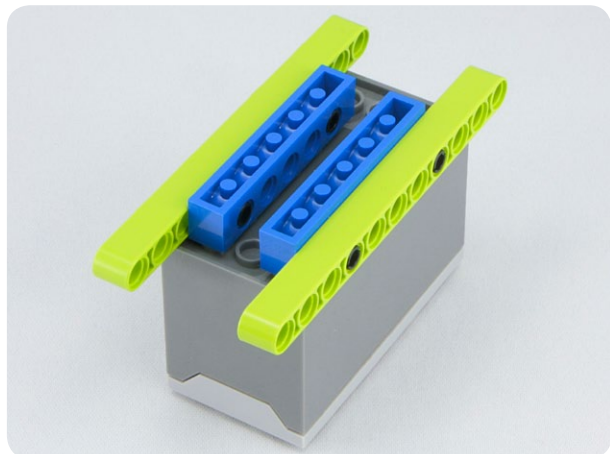
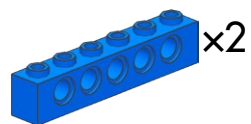
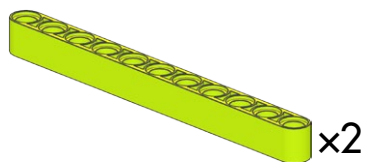
x4



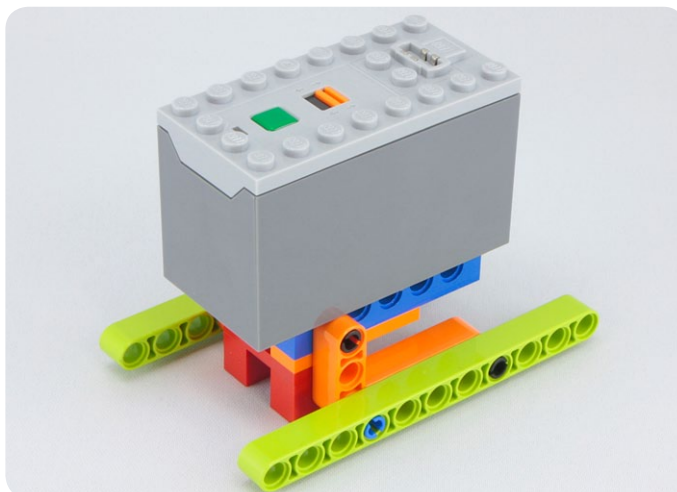
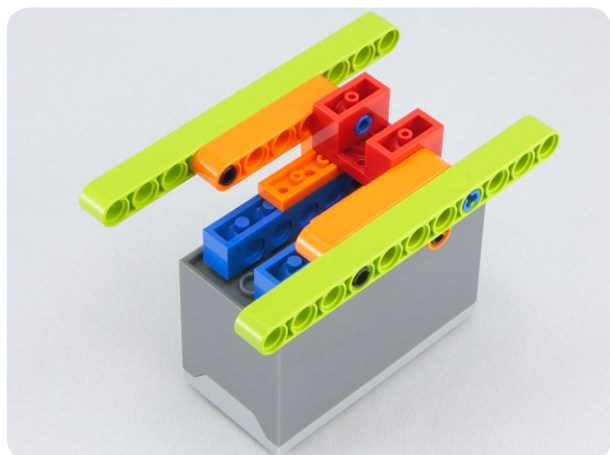
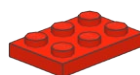
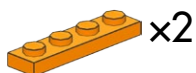
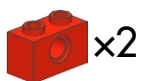
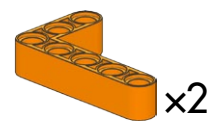
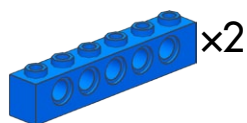
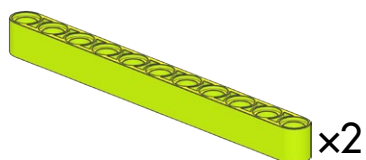
x4



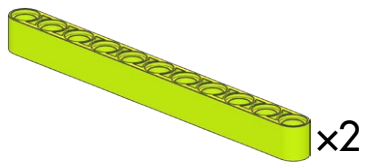
#213



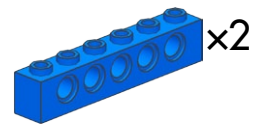
#214



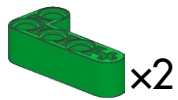
#215



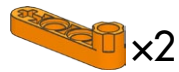
x2



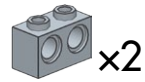
x2



x2



x2



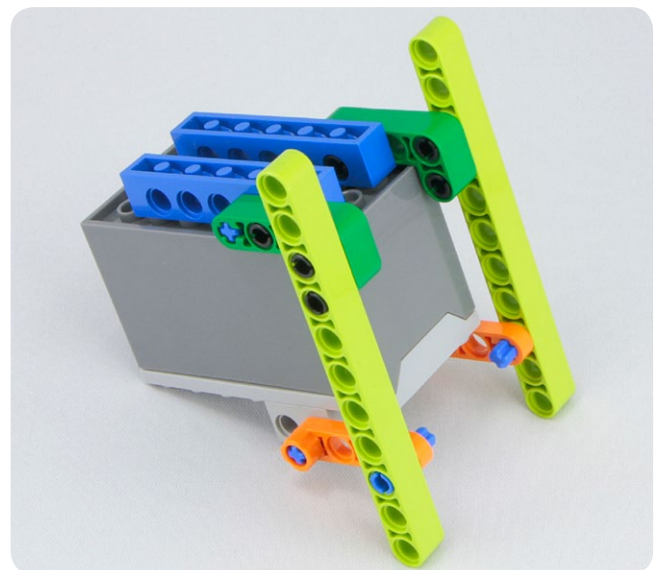
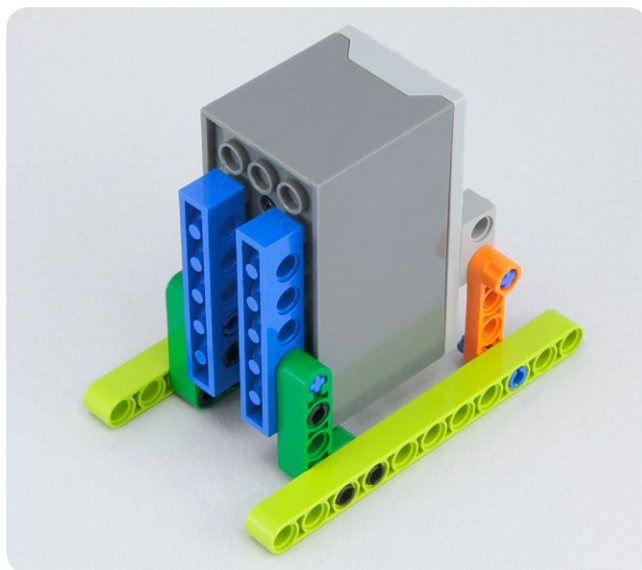
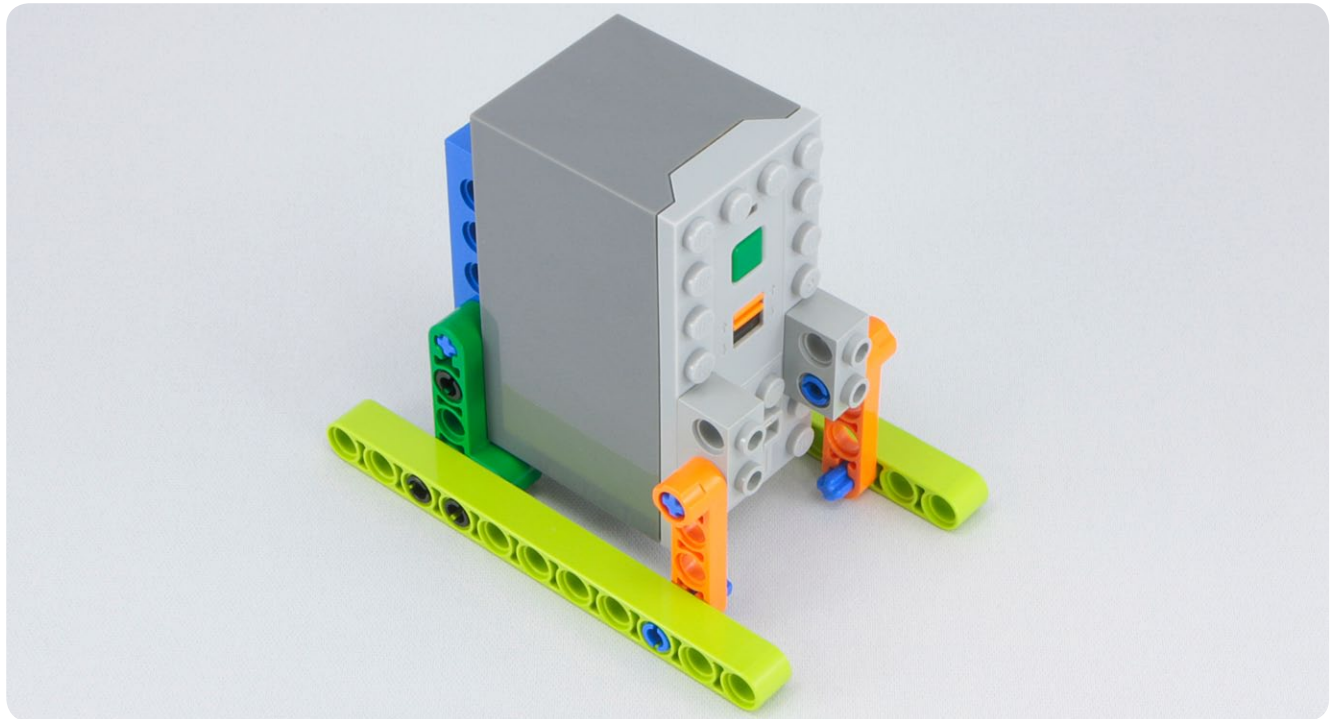
x2

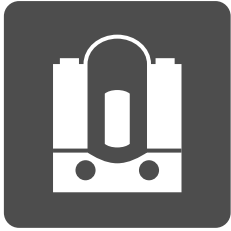


x6

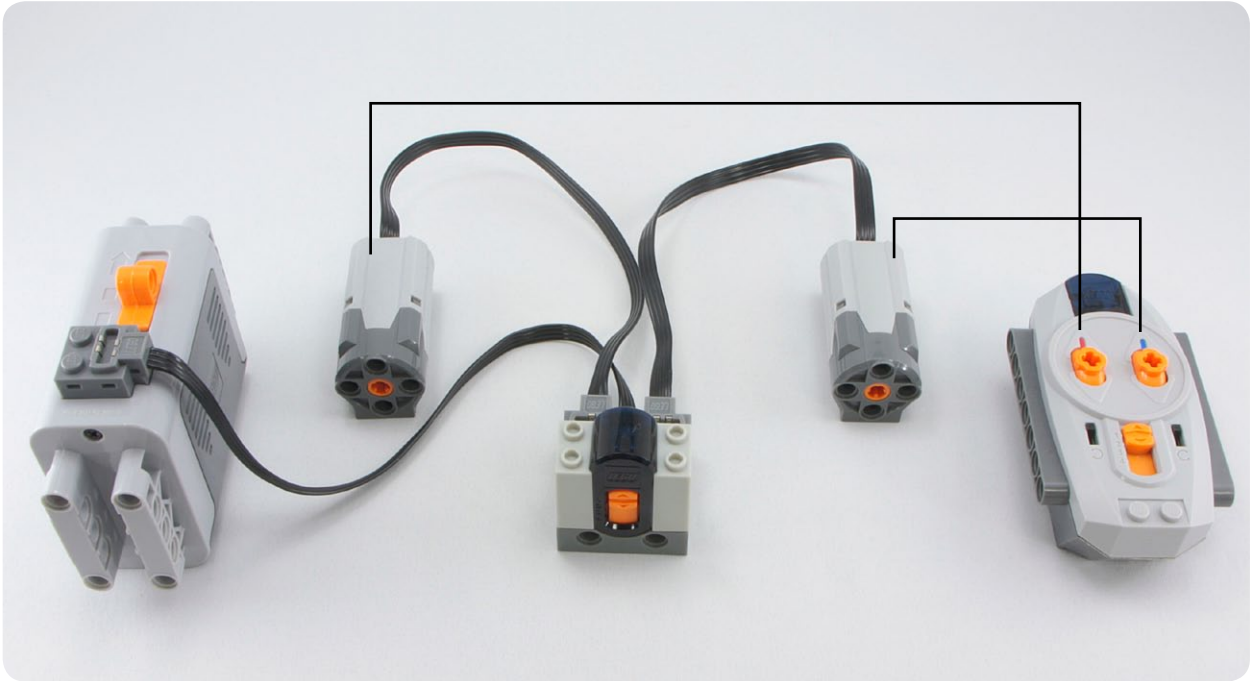


x6

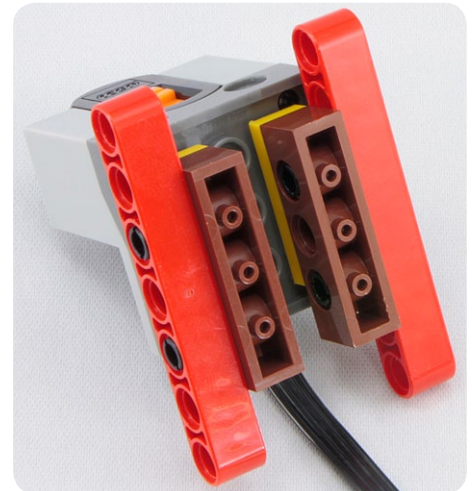
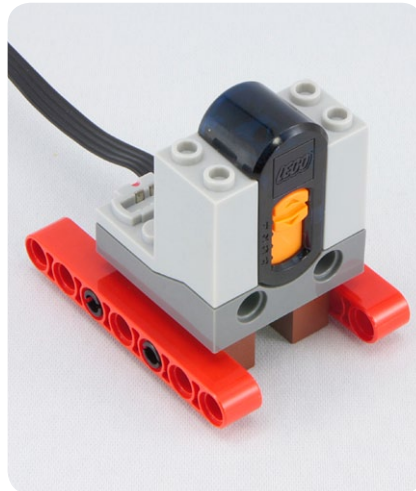
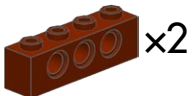




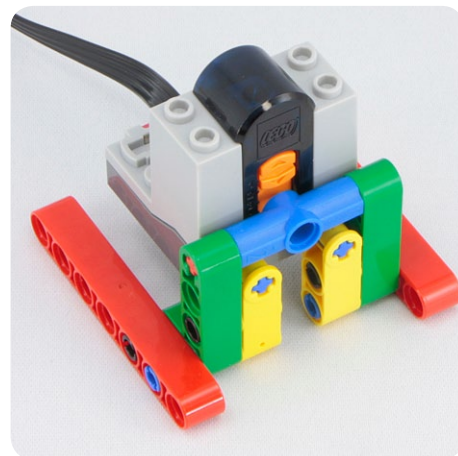
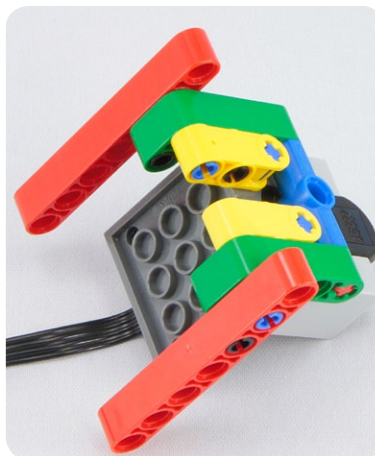
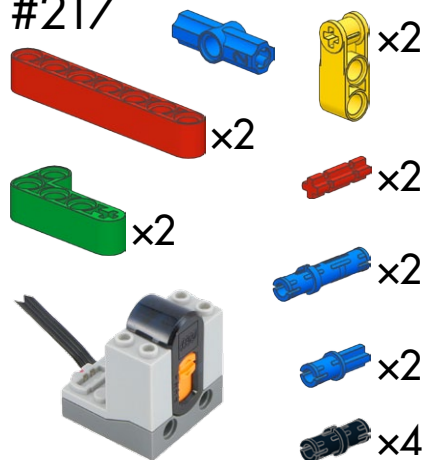
Attaching an infrared receiver



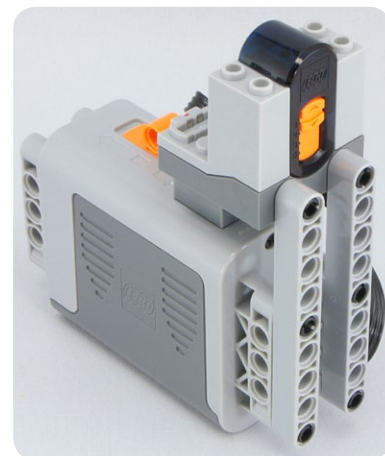
#216



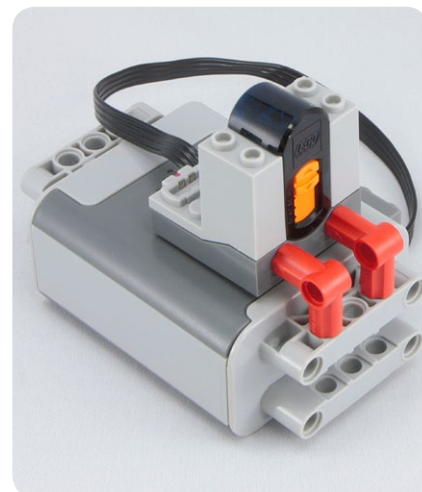
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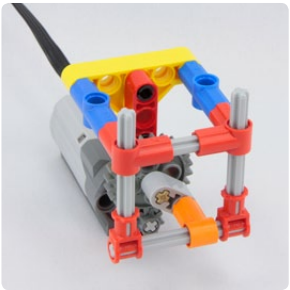
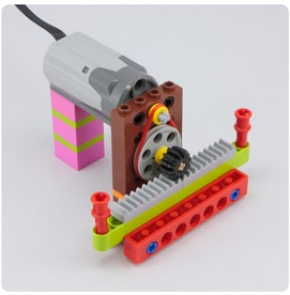


#218



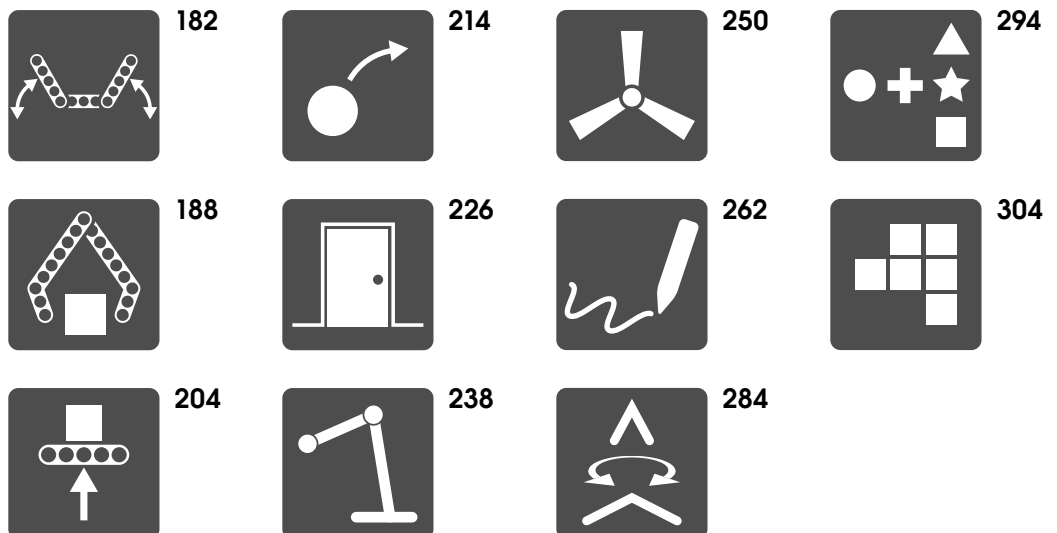
#219

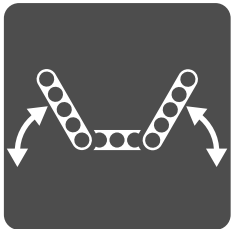




PART 2

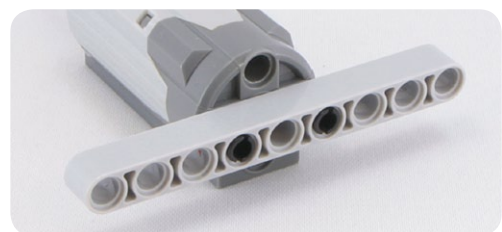
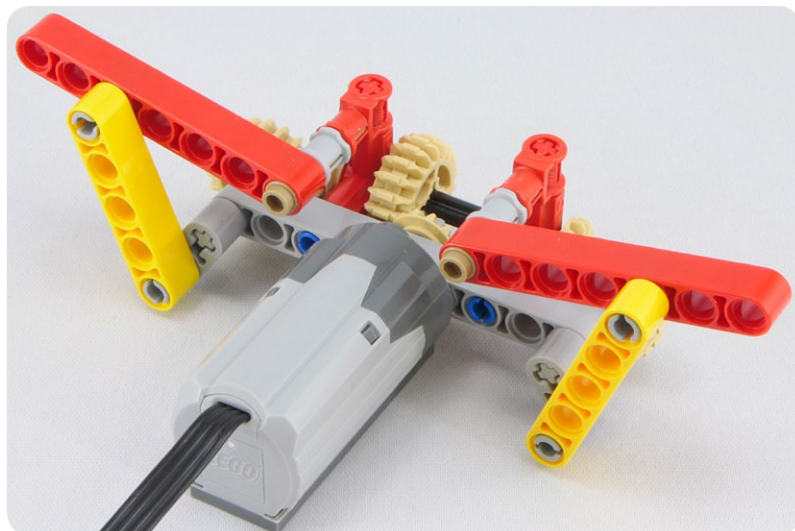
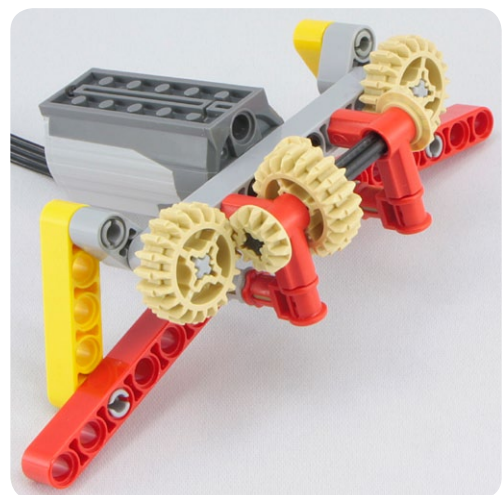
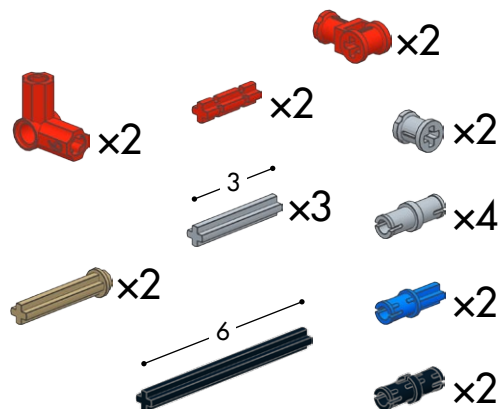
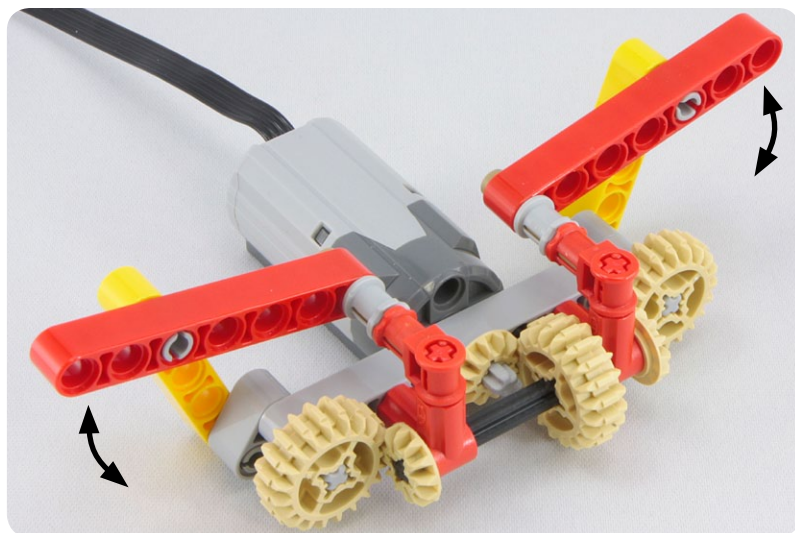
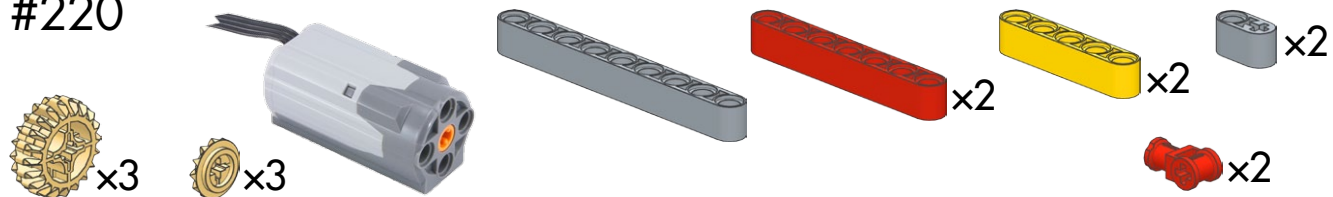
Arms, Wings, and Other Movements



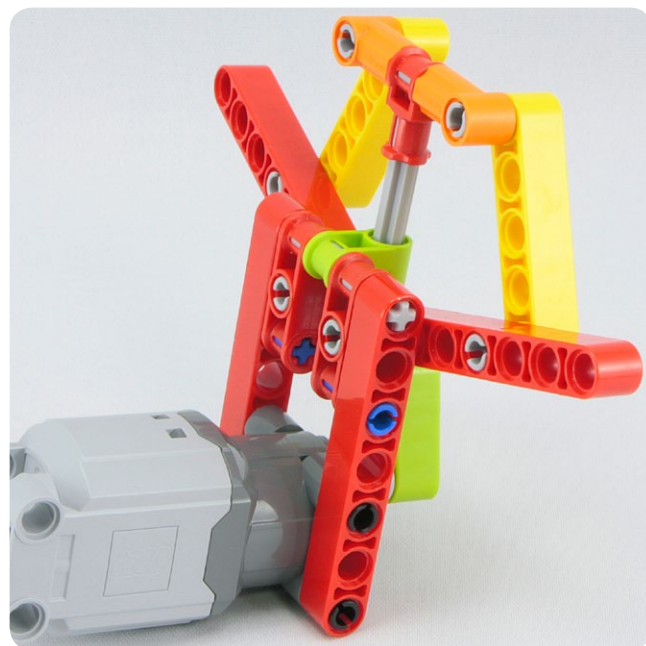
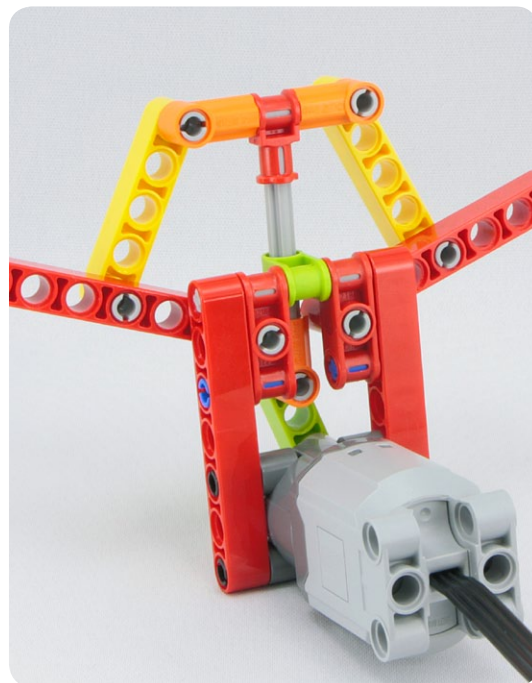
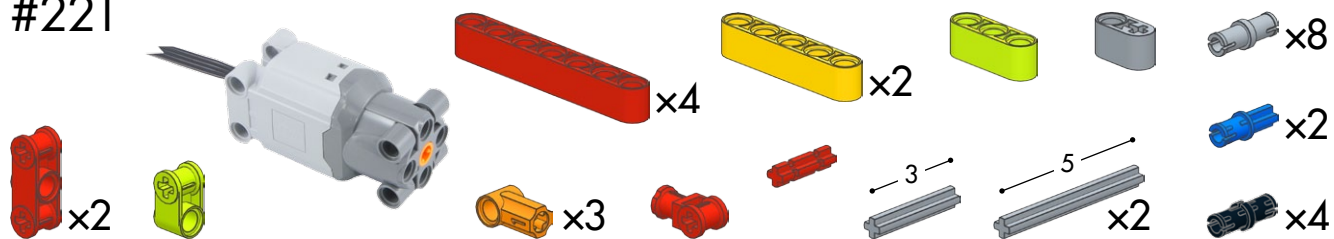


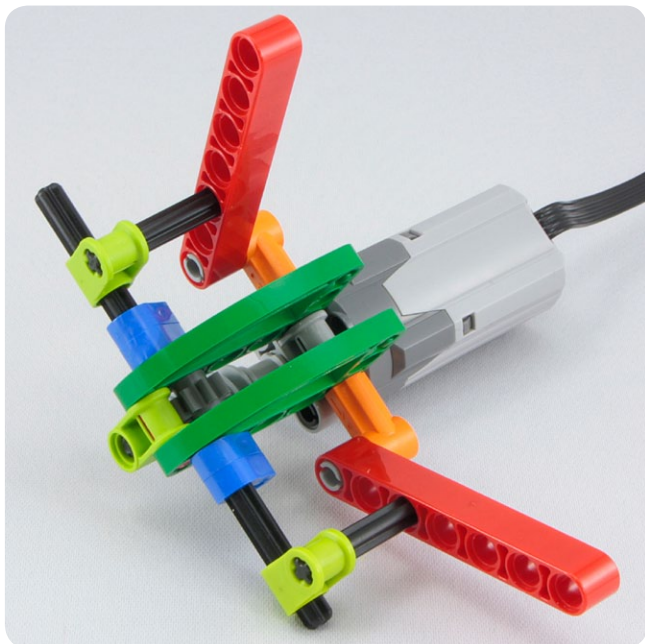
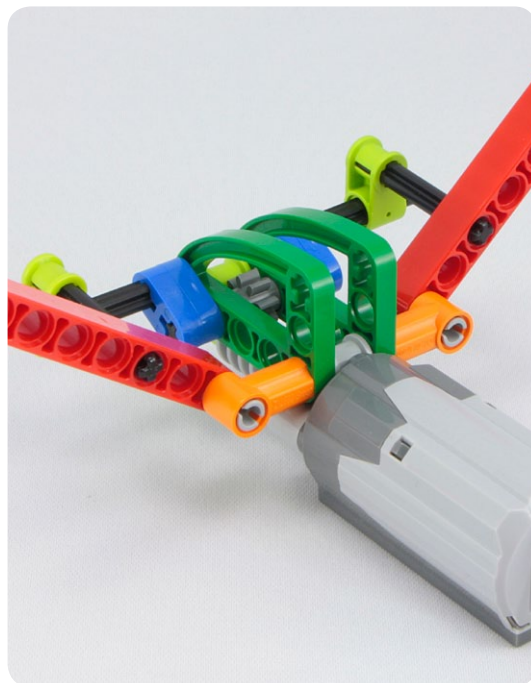
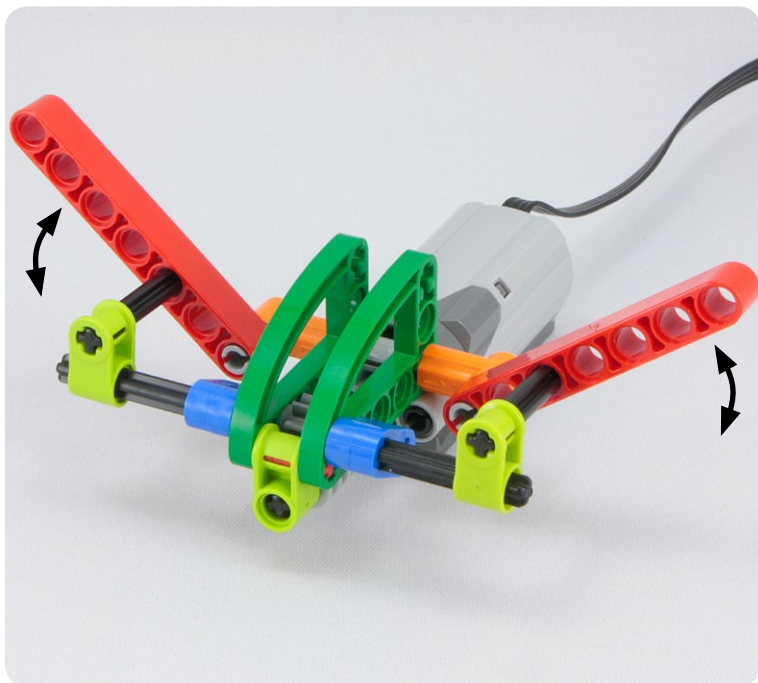
Flapping wings

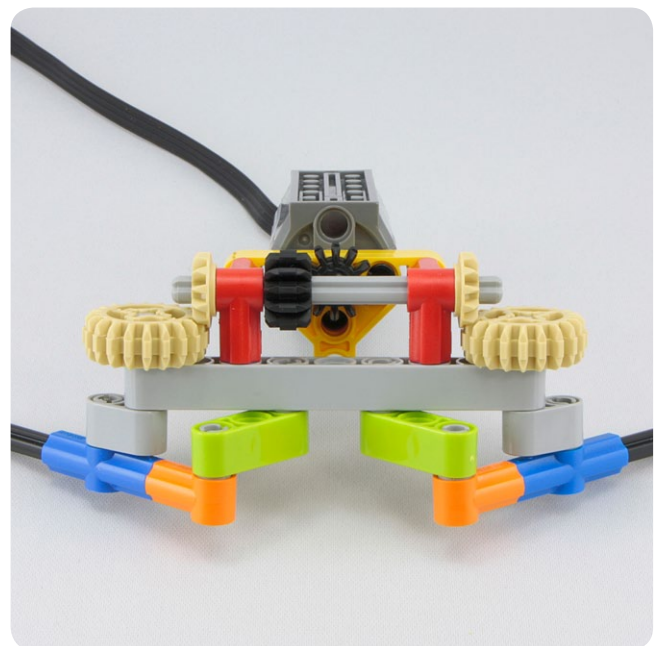
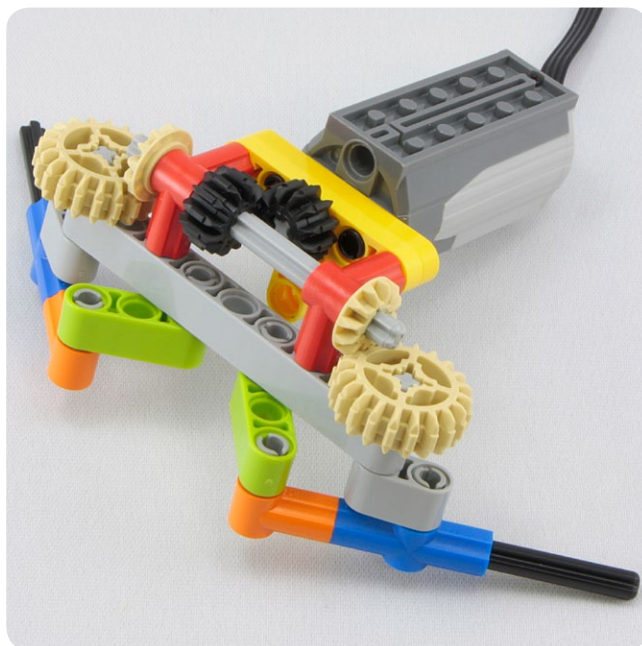
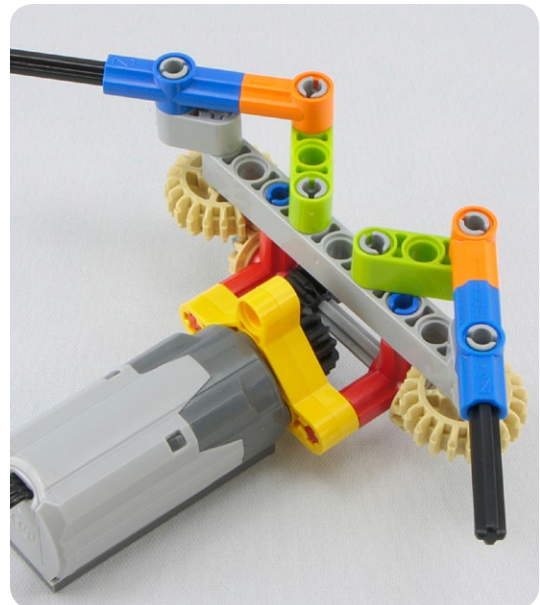
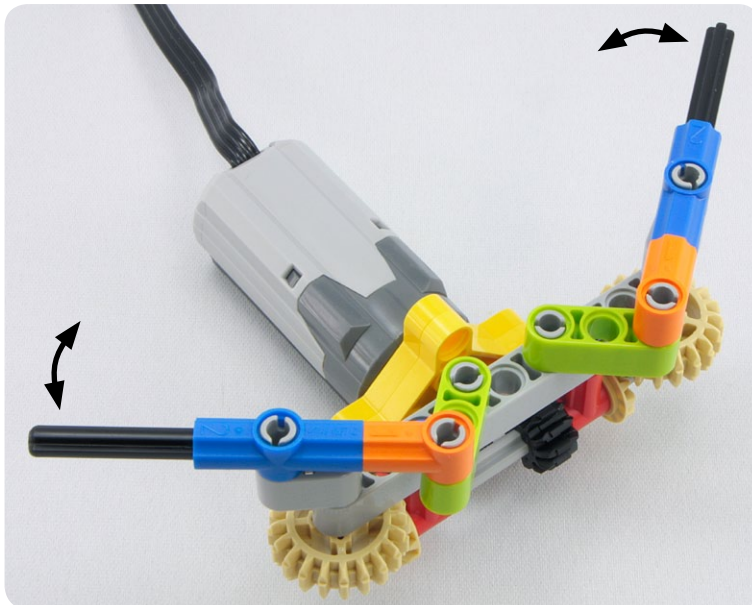
#220

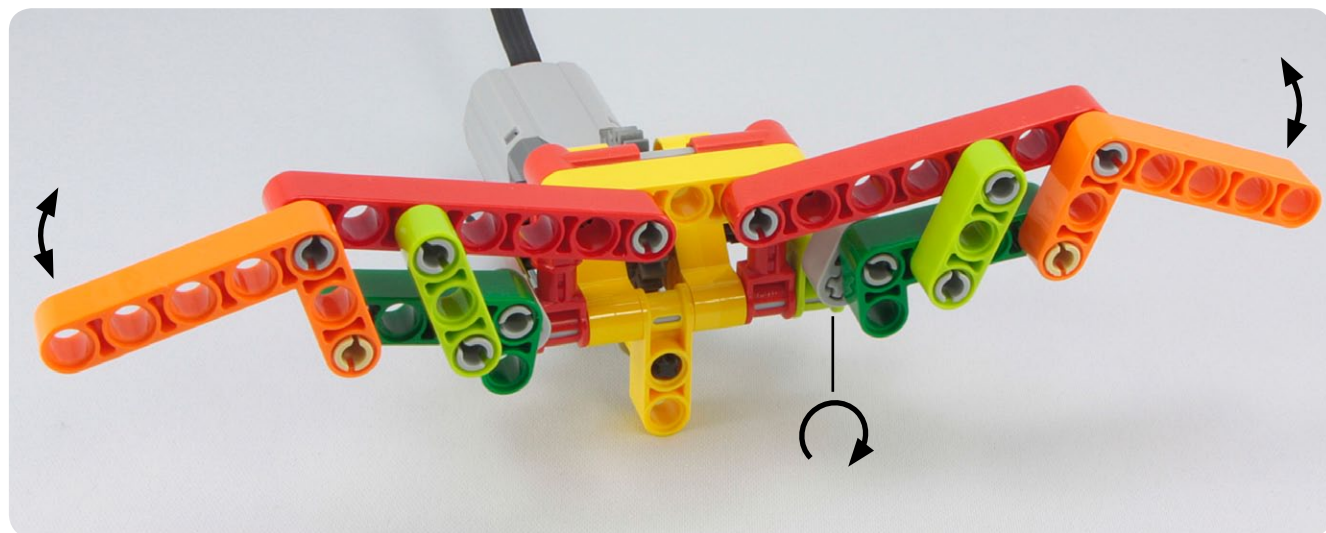


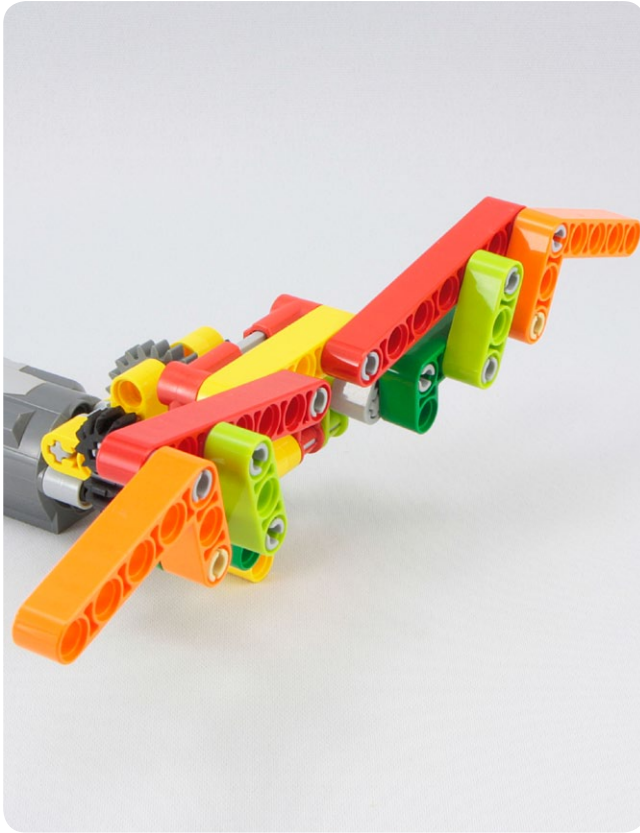
#221

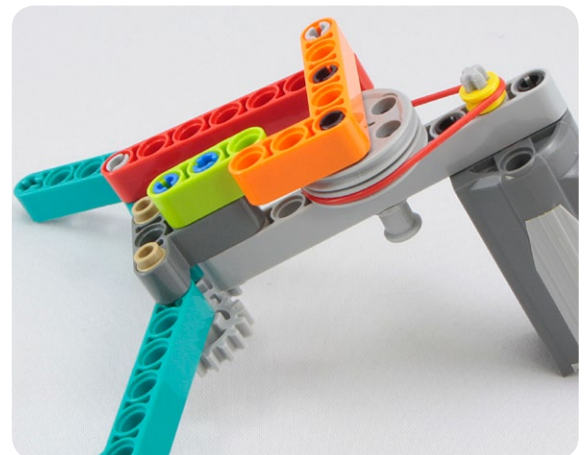
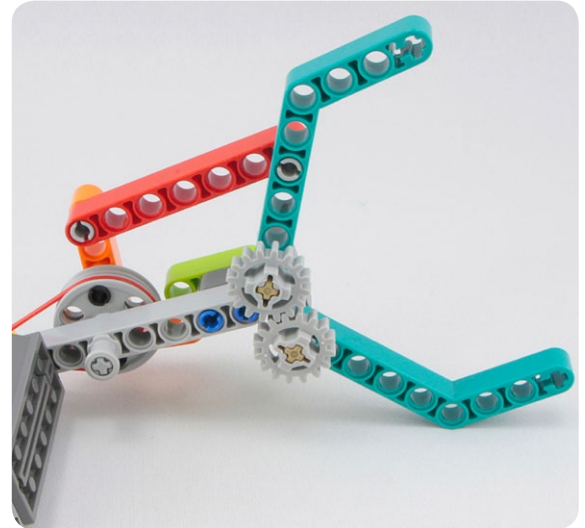


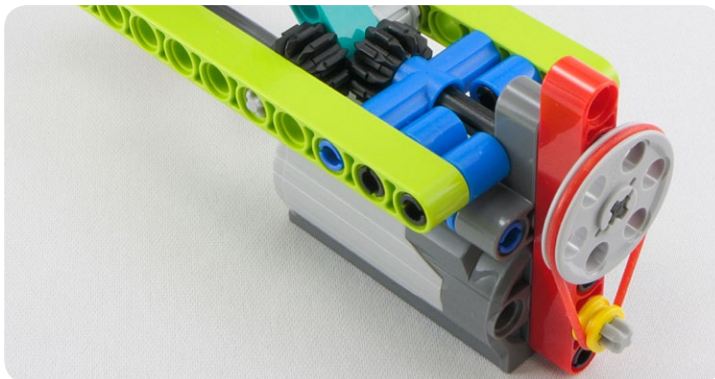
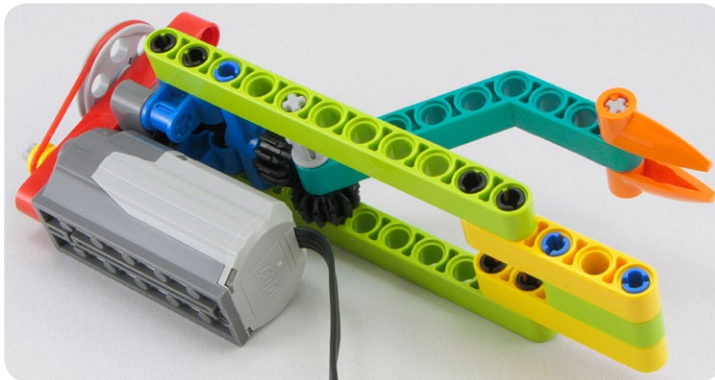
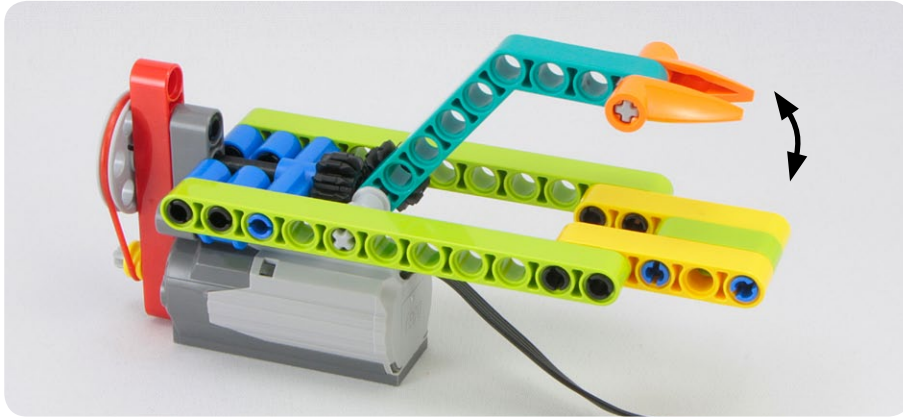
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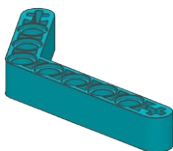
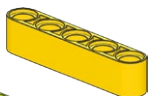
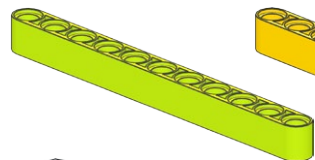
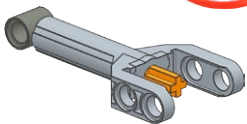
[illegible]

[illegible]



[illegible]



 $\times 2$ 

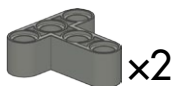
x2

 x8

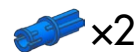
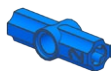
x2

 $\times 2$ 

x5



x2



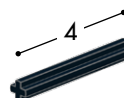
x2



x3



x3



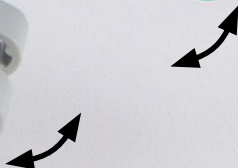
4

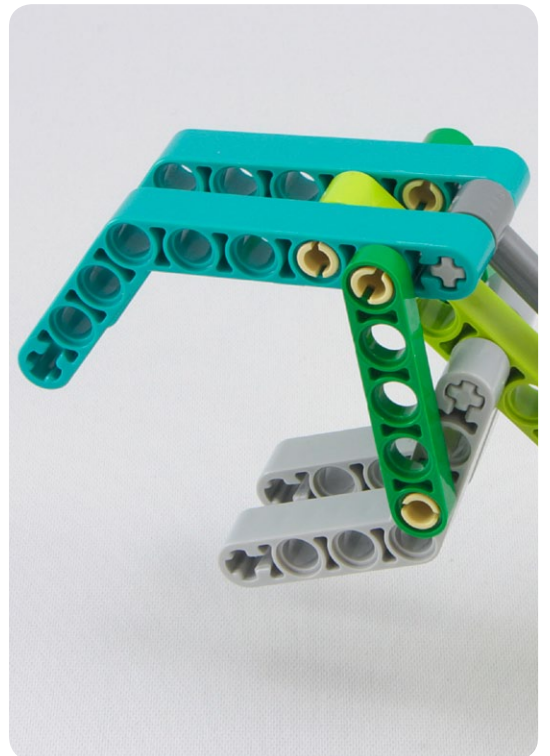
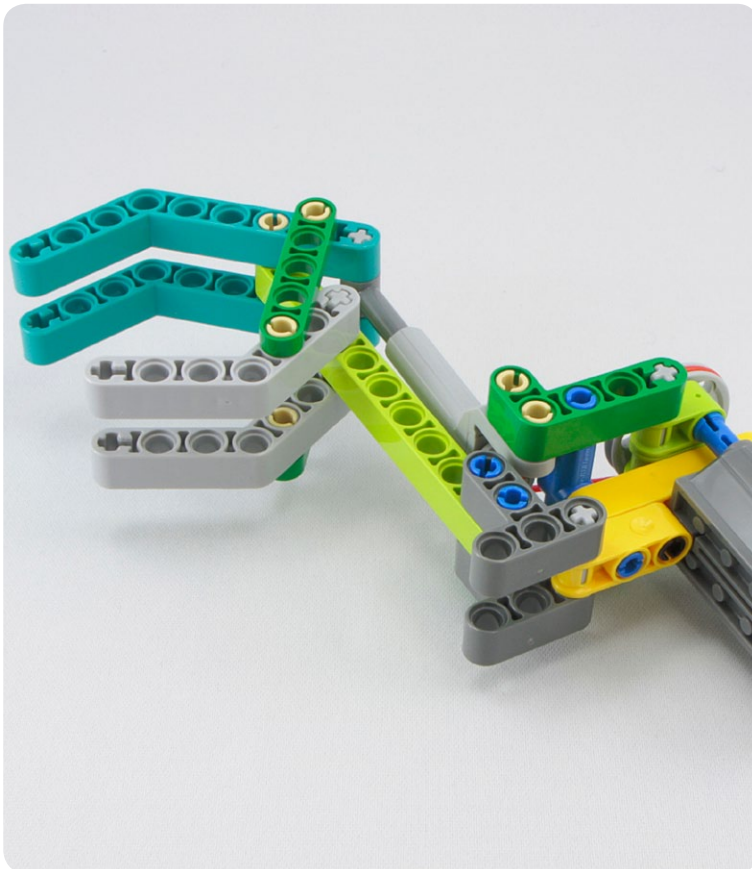
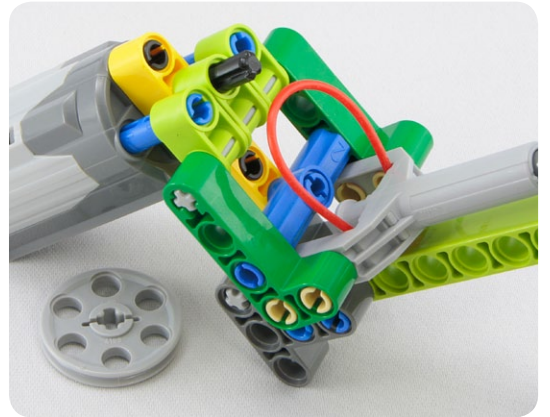
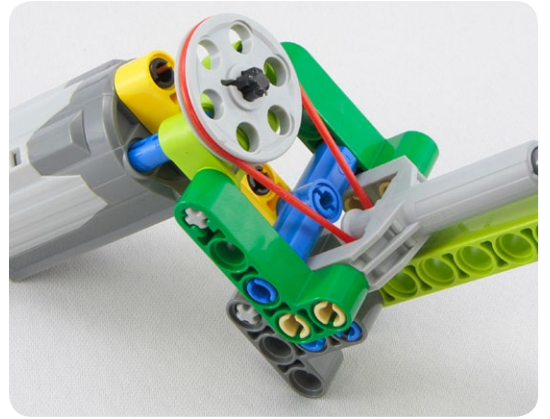
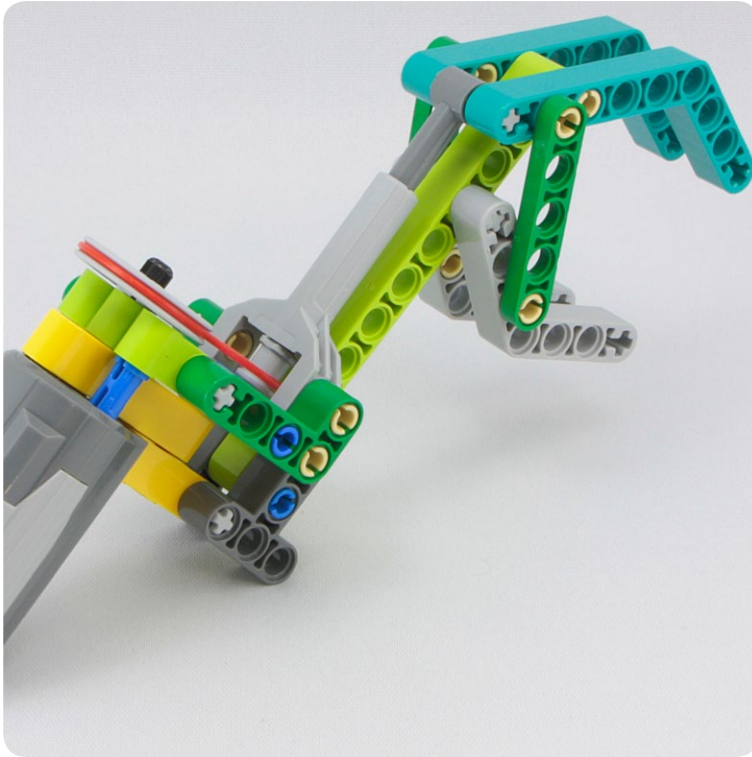


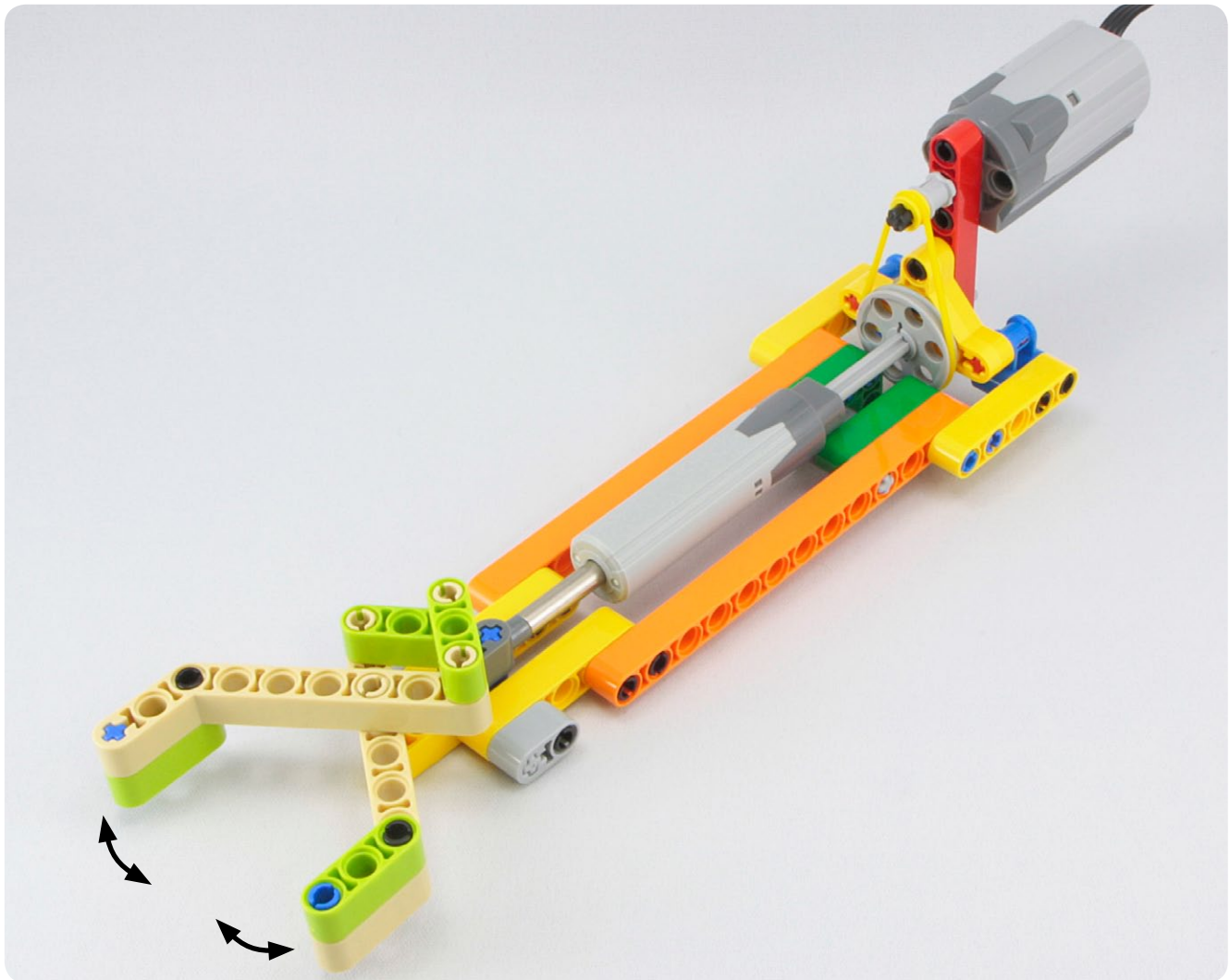
5-

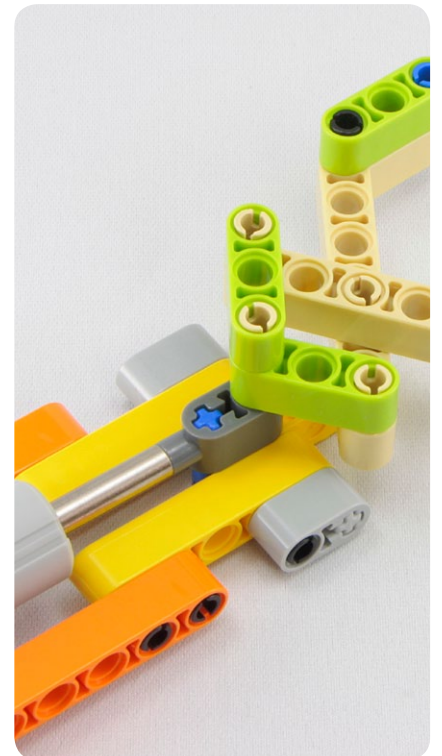
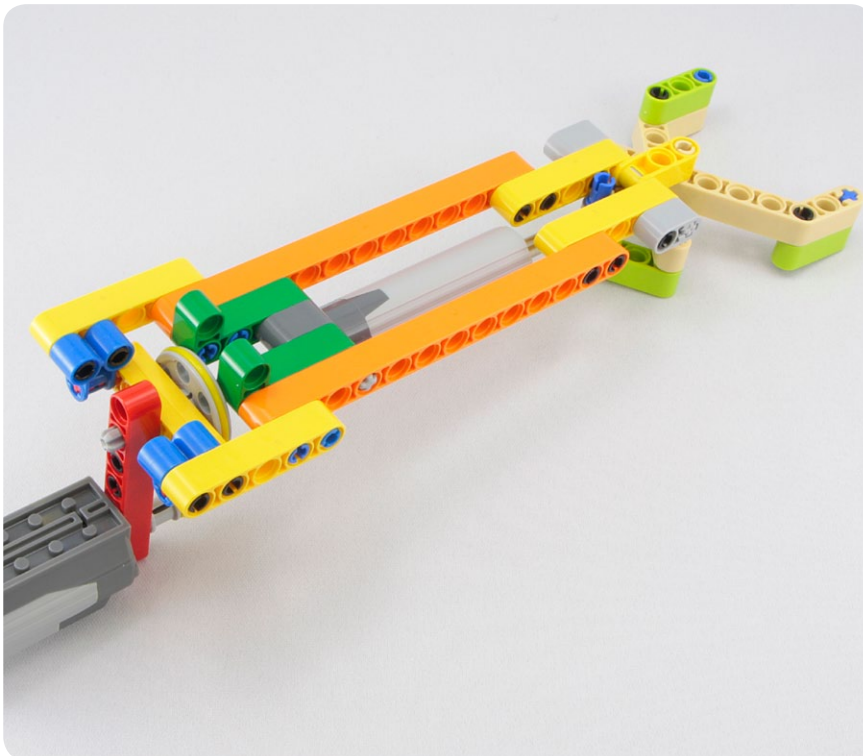
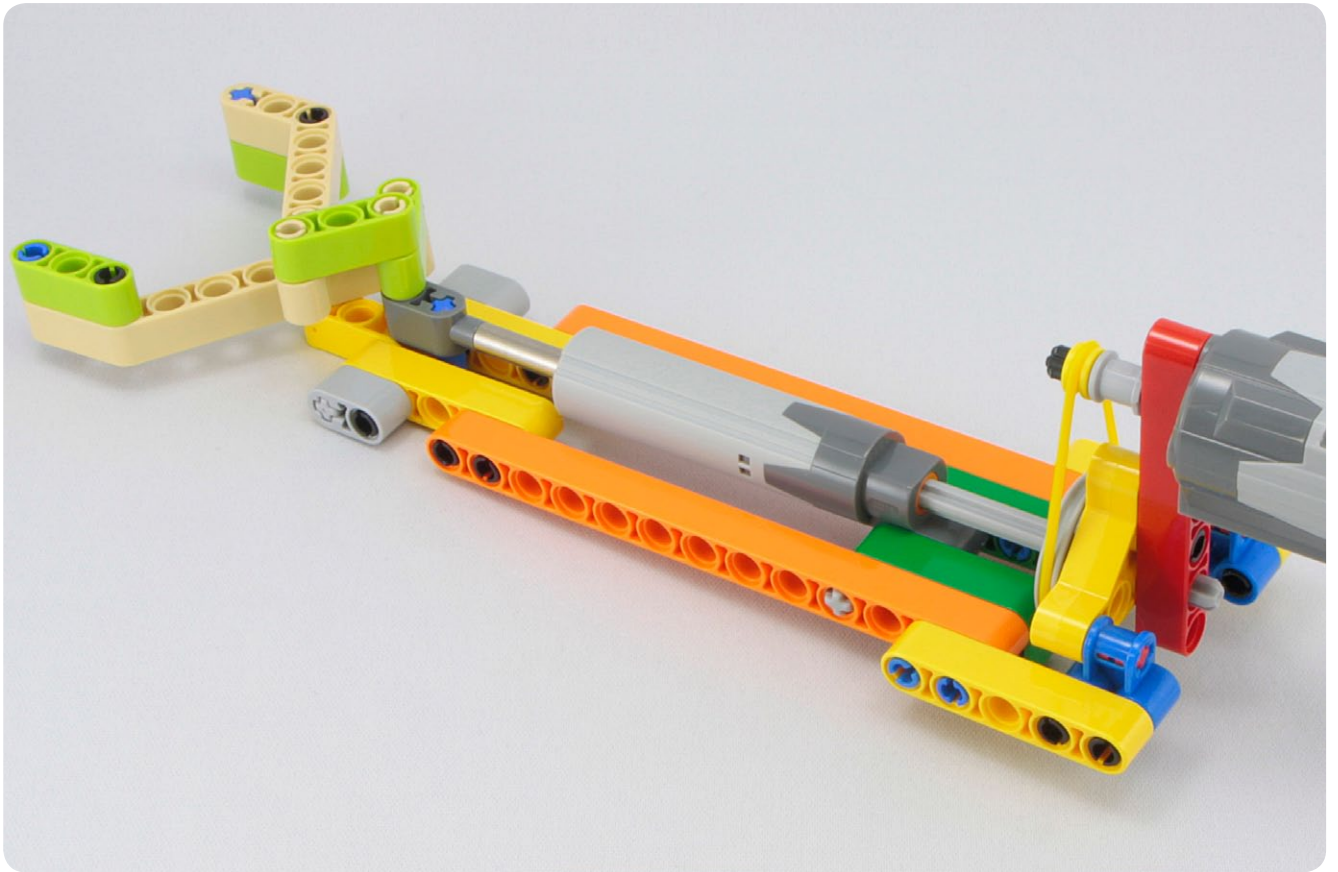


x3

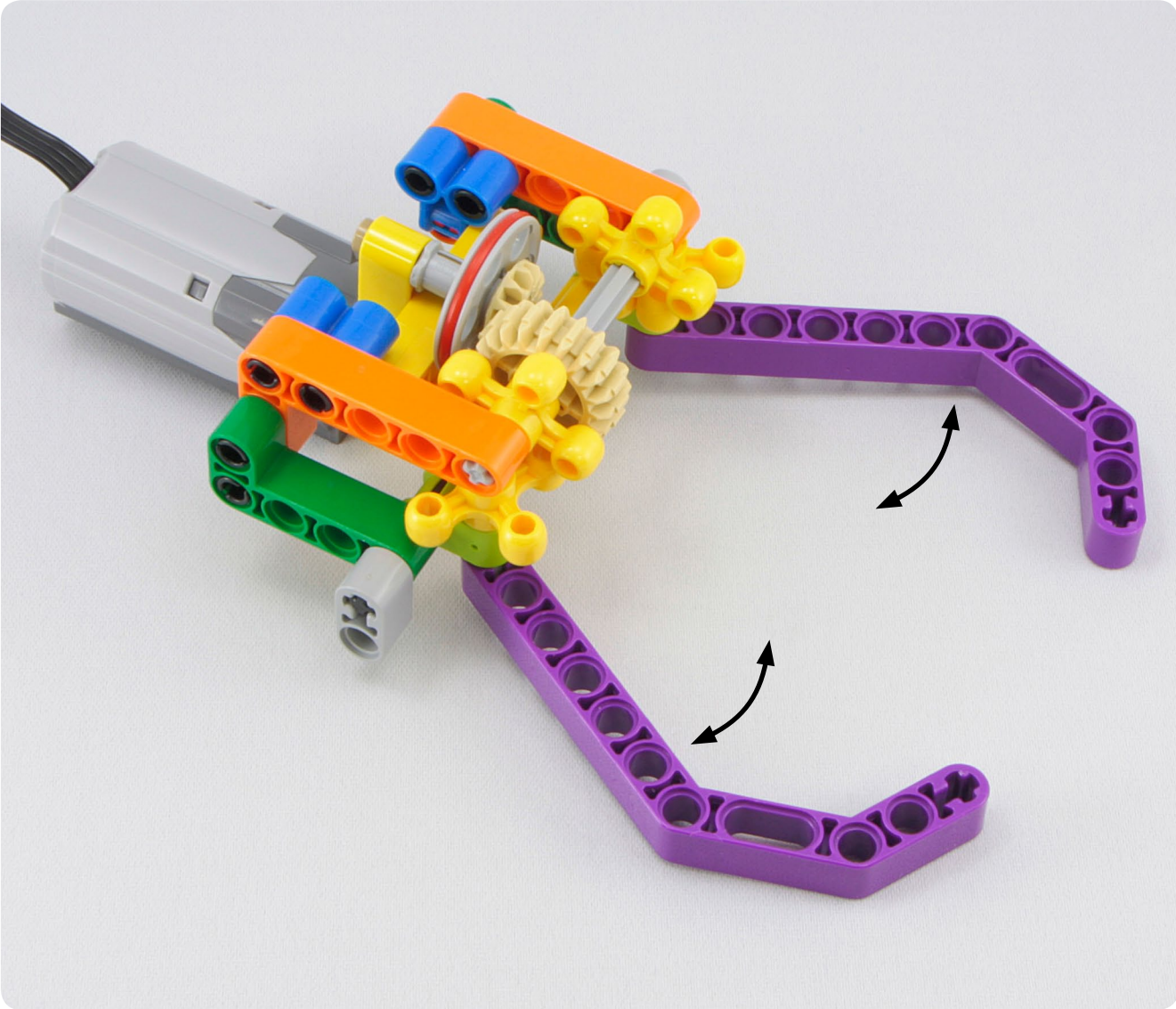
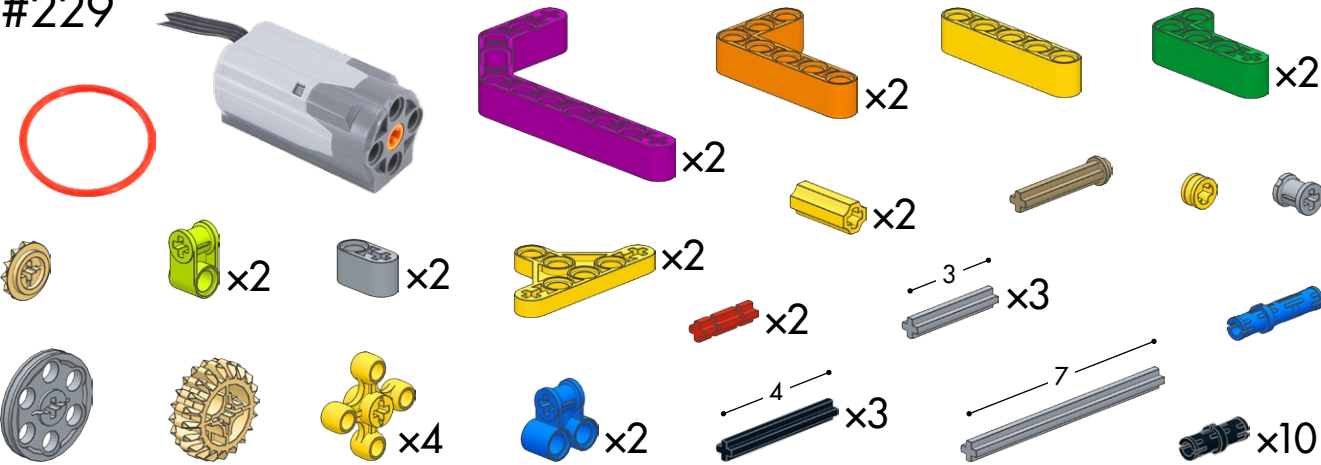


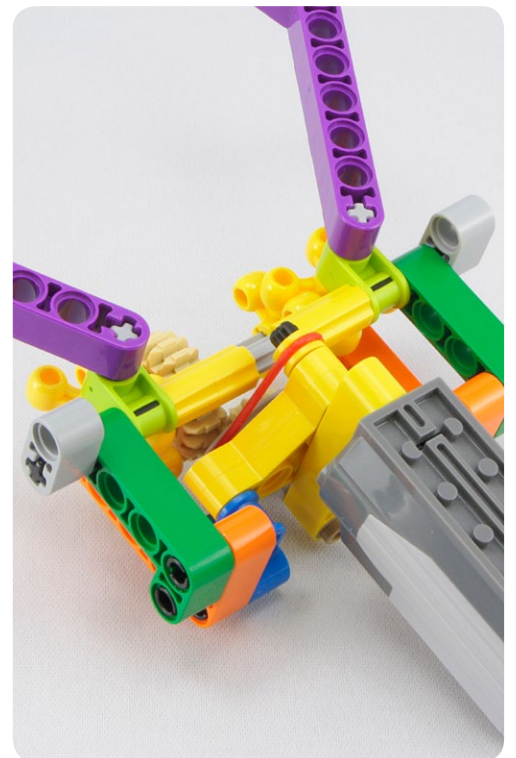
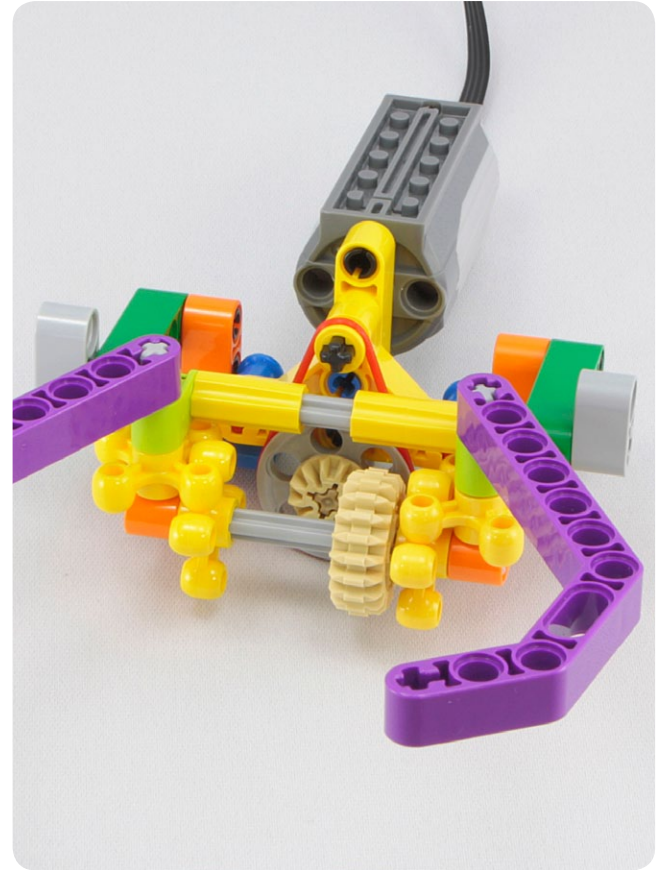
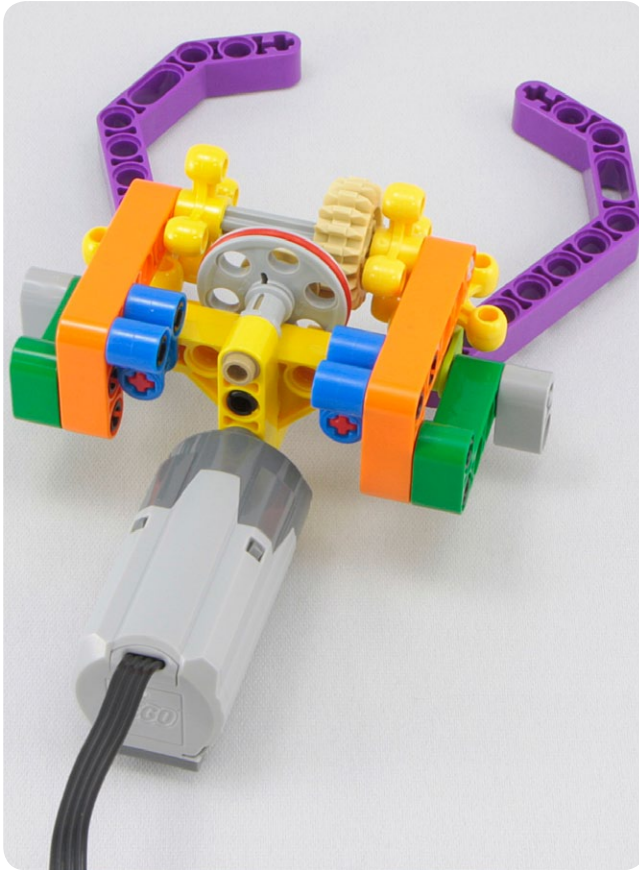


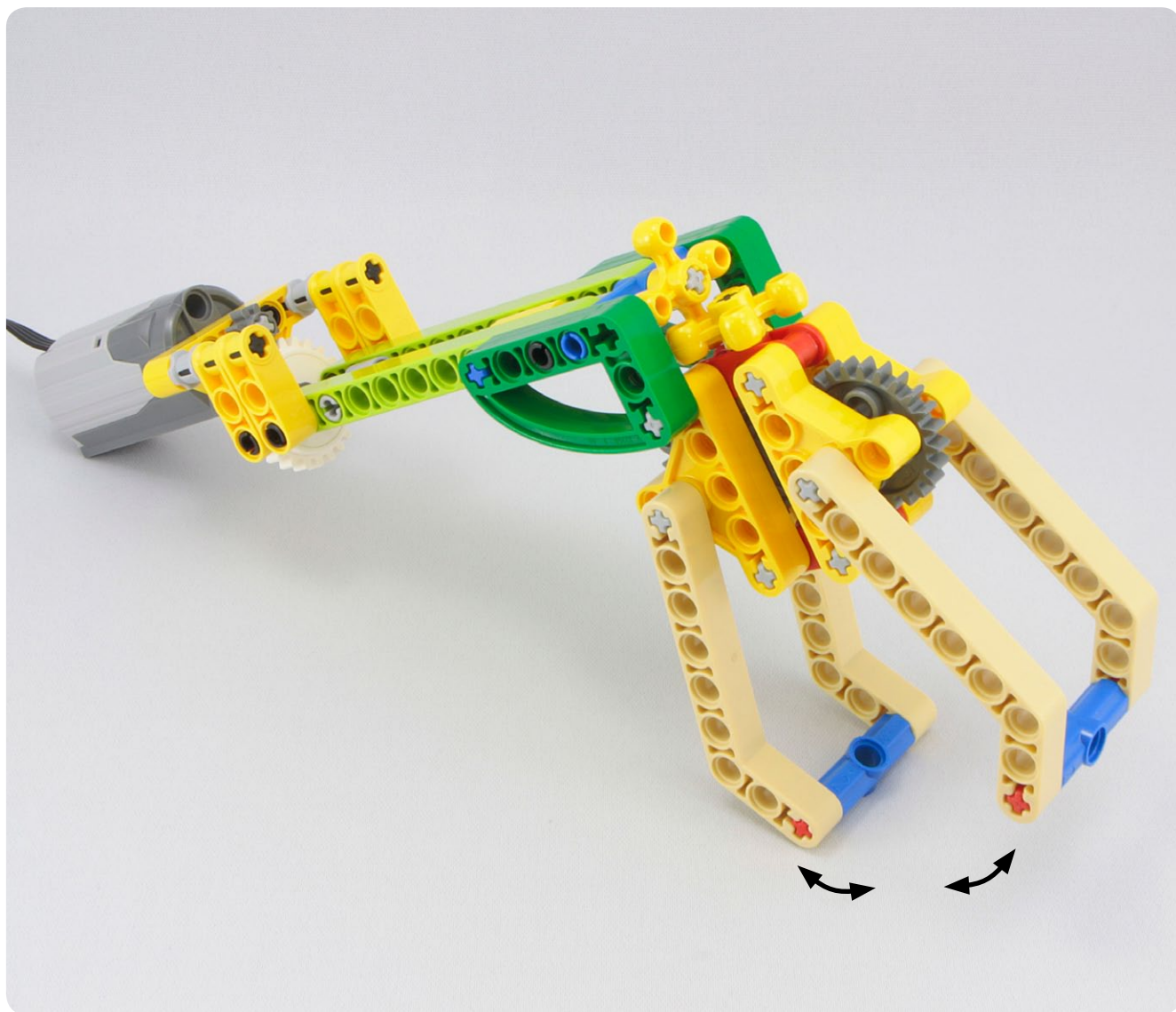
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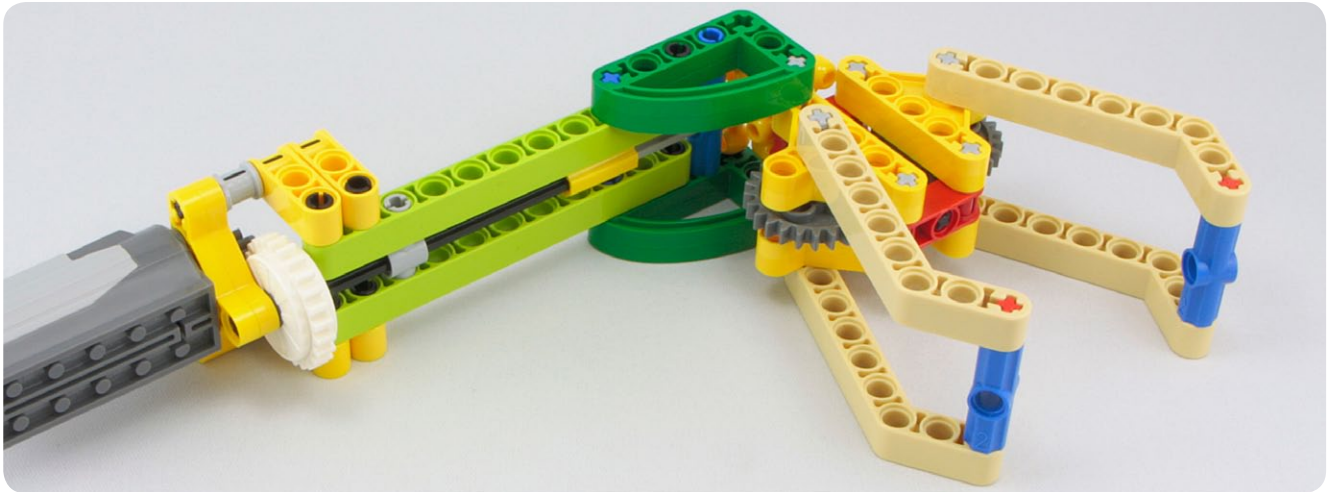
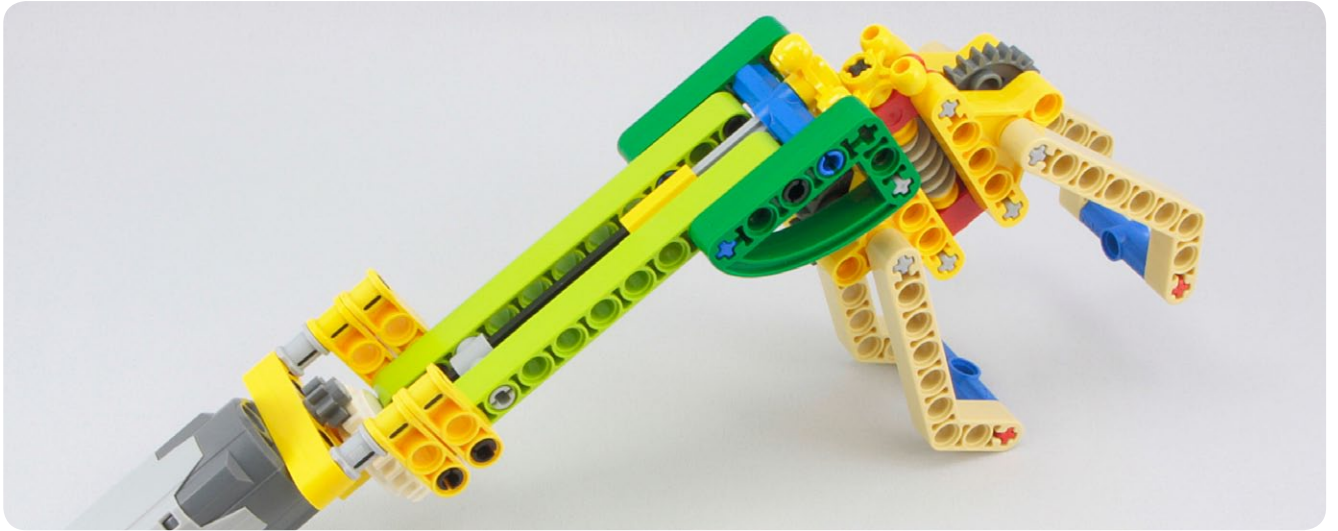


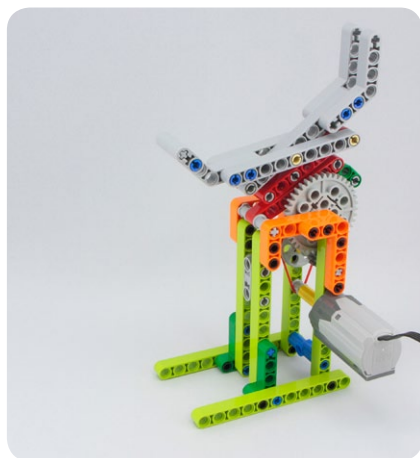
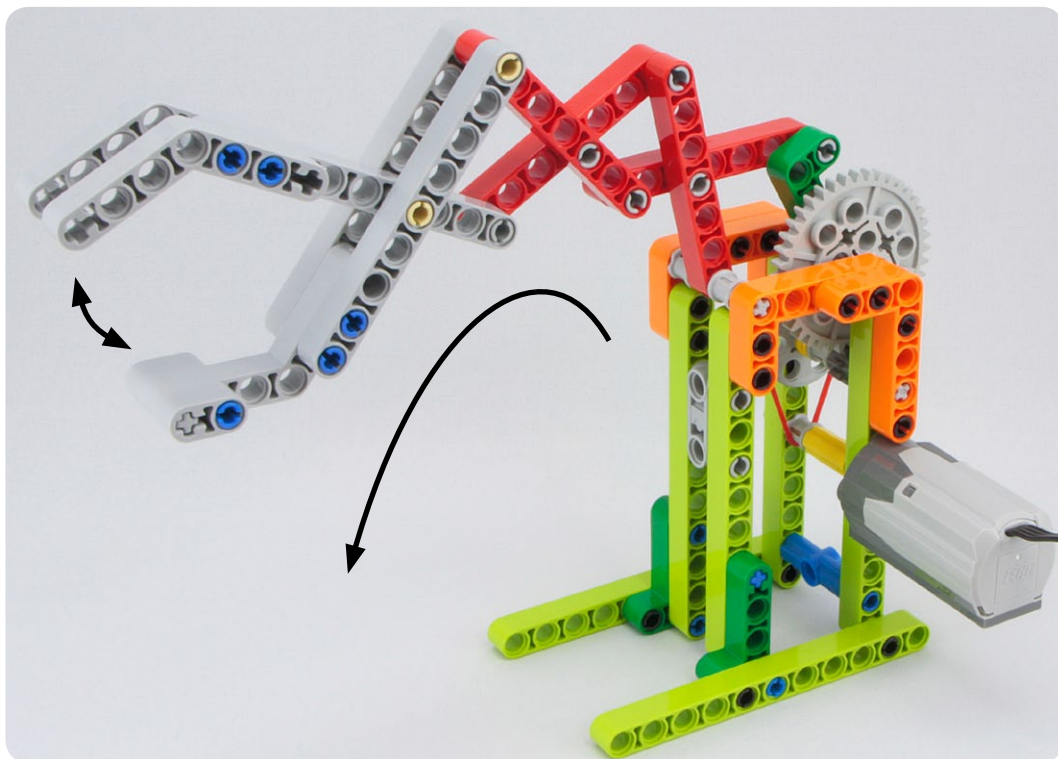
#229

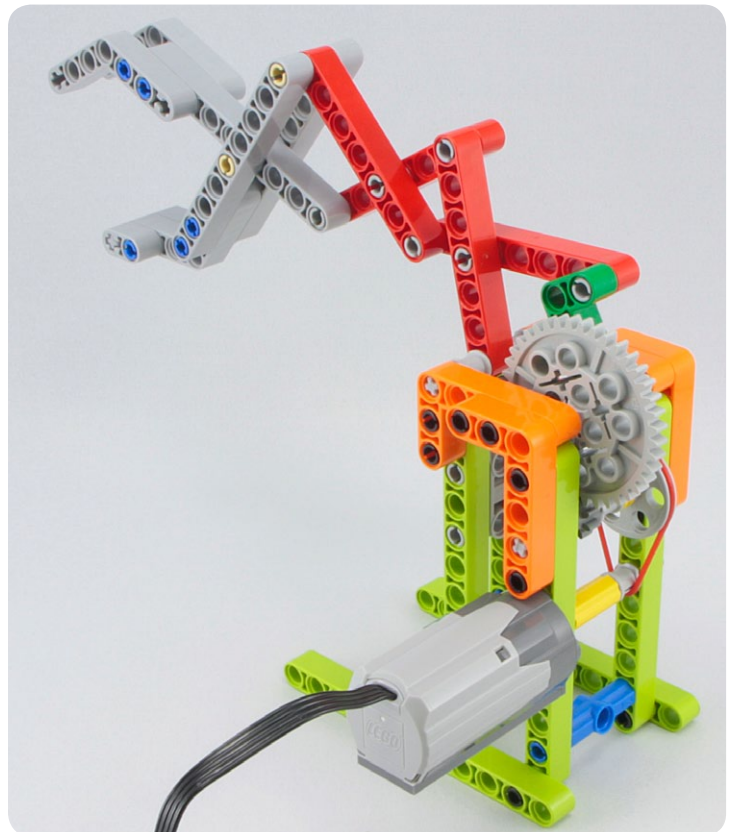
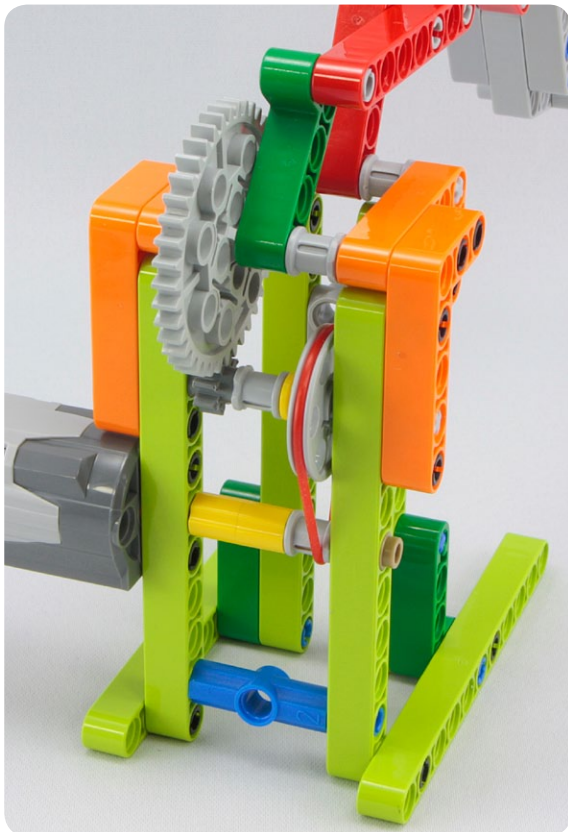
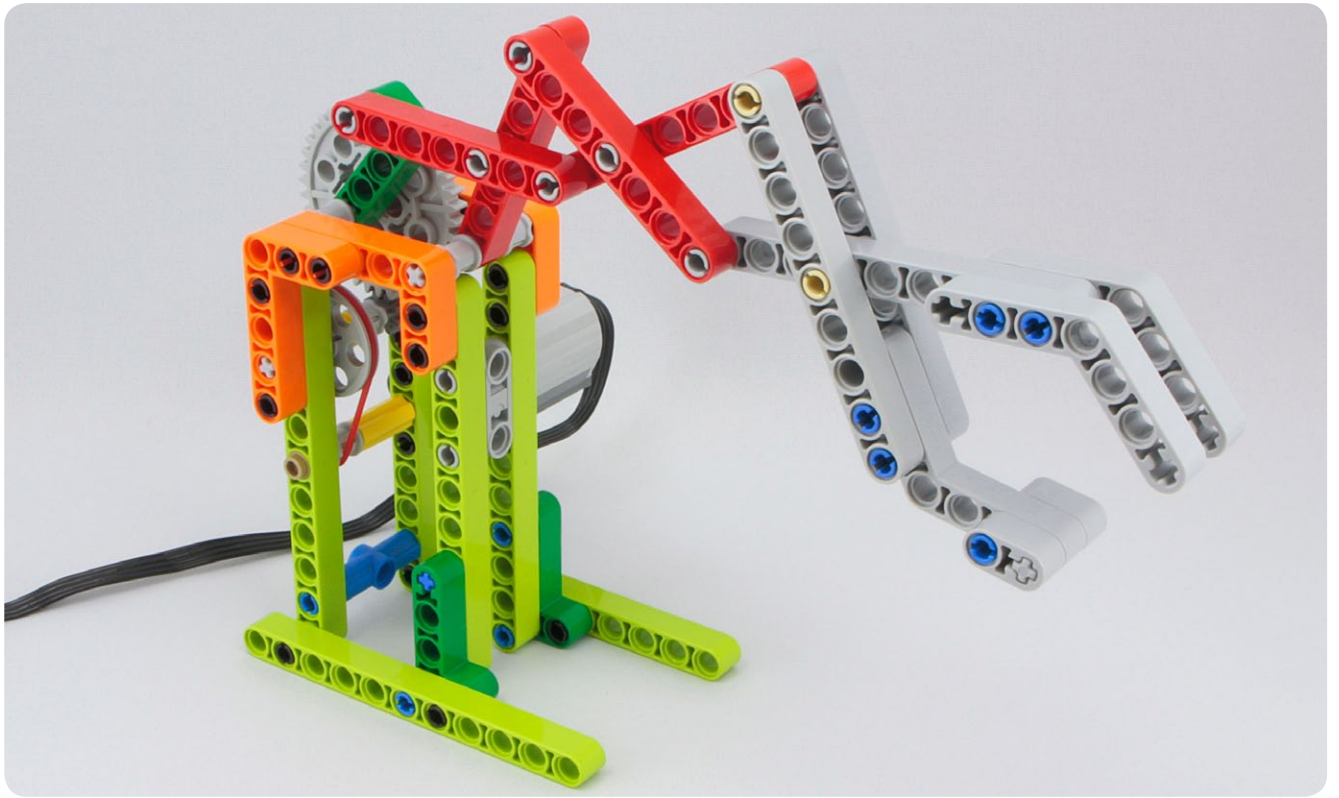


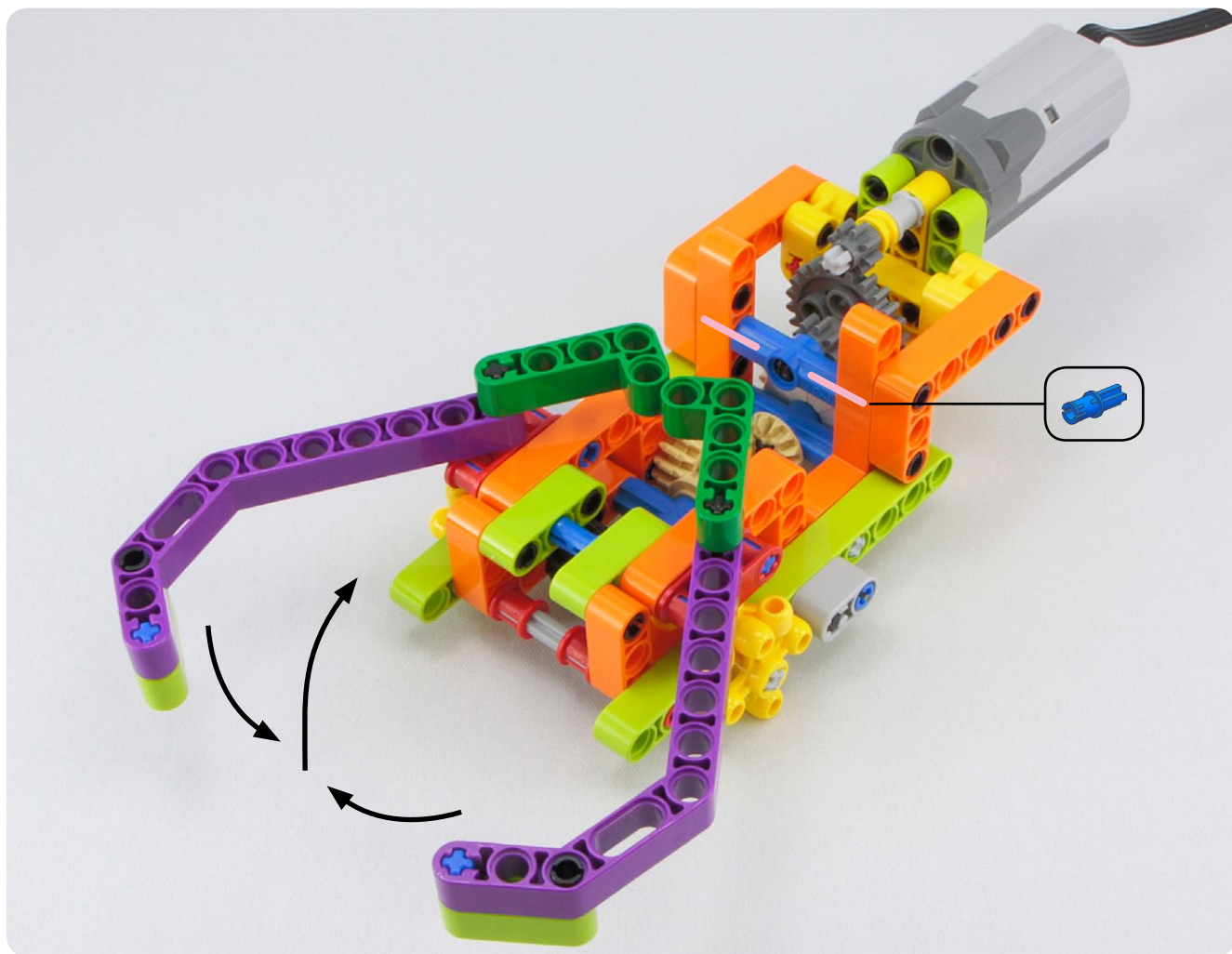


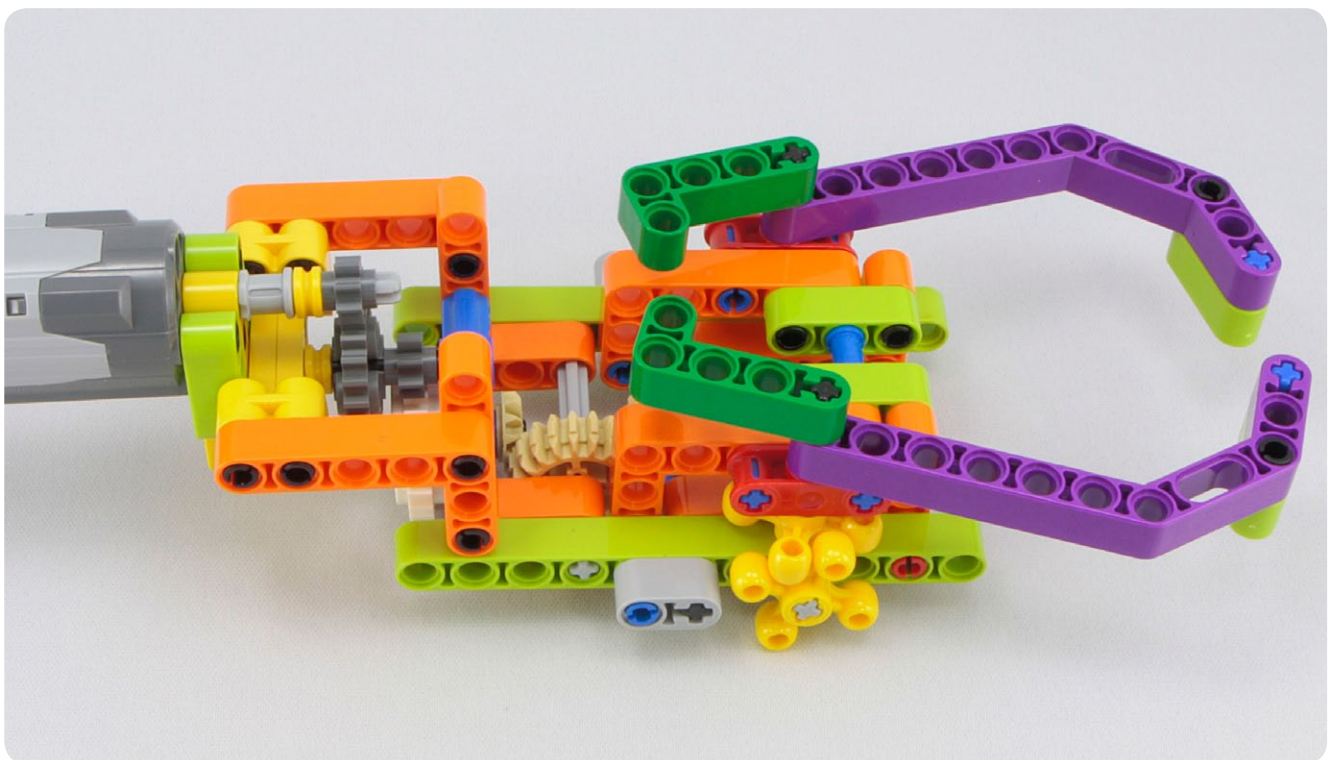
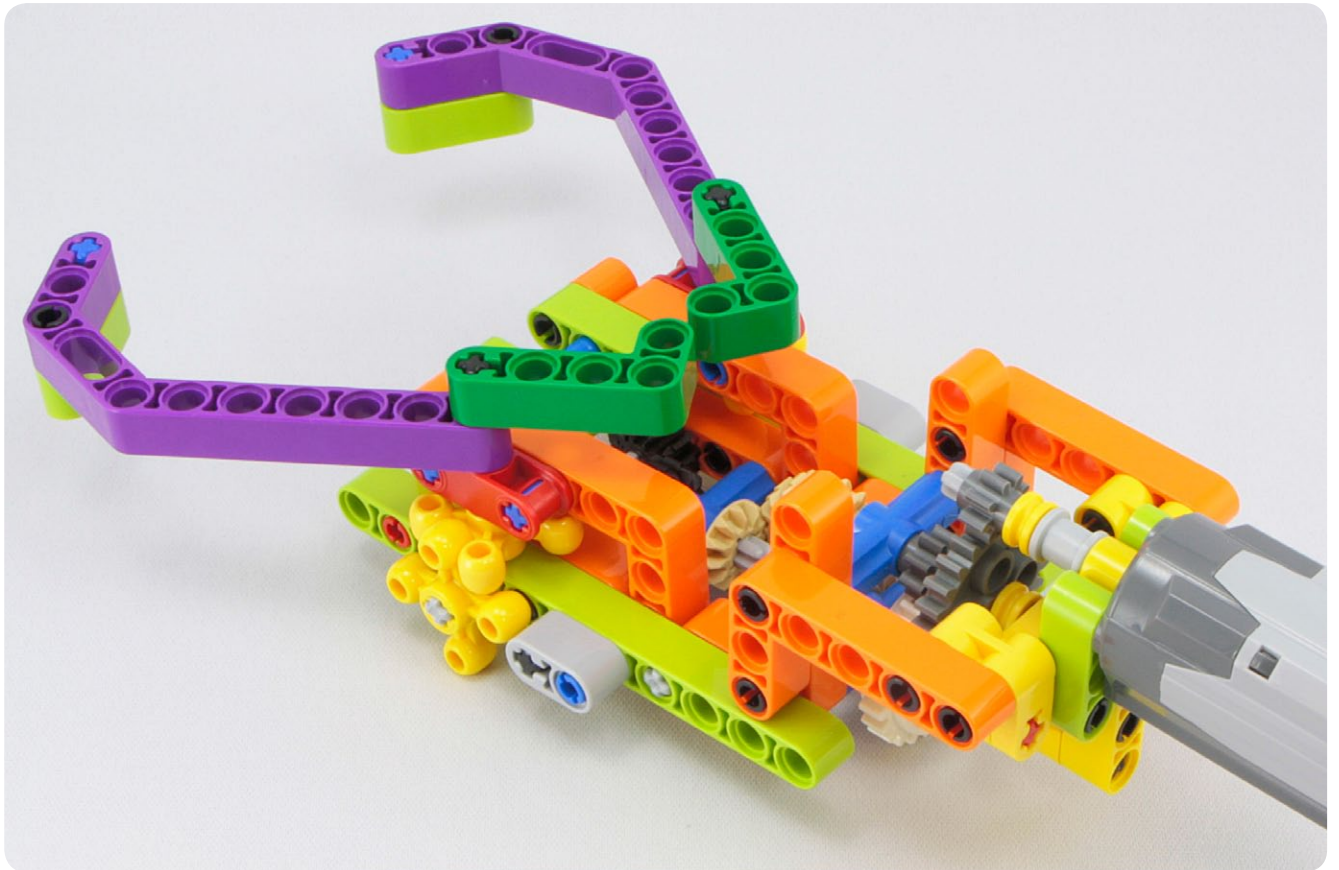
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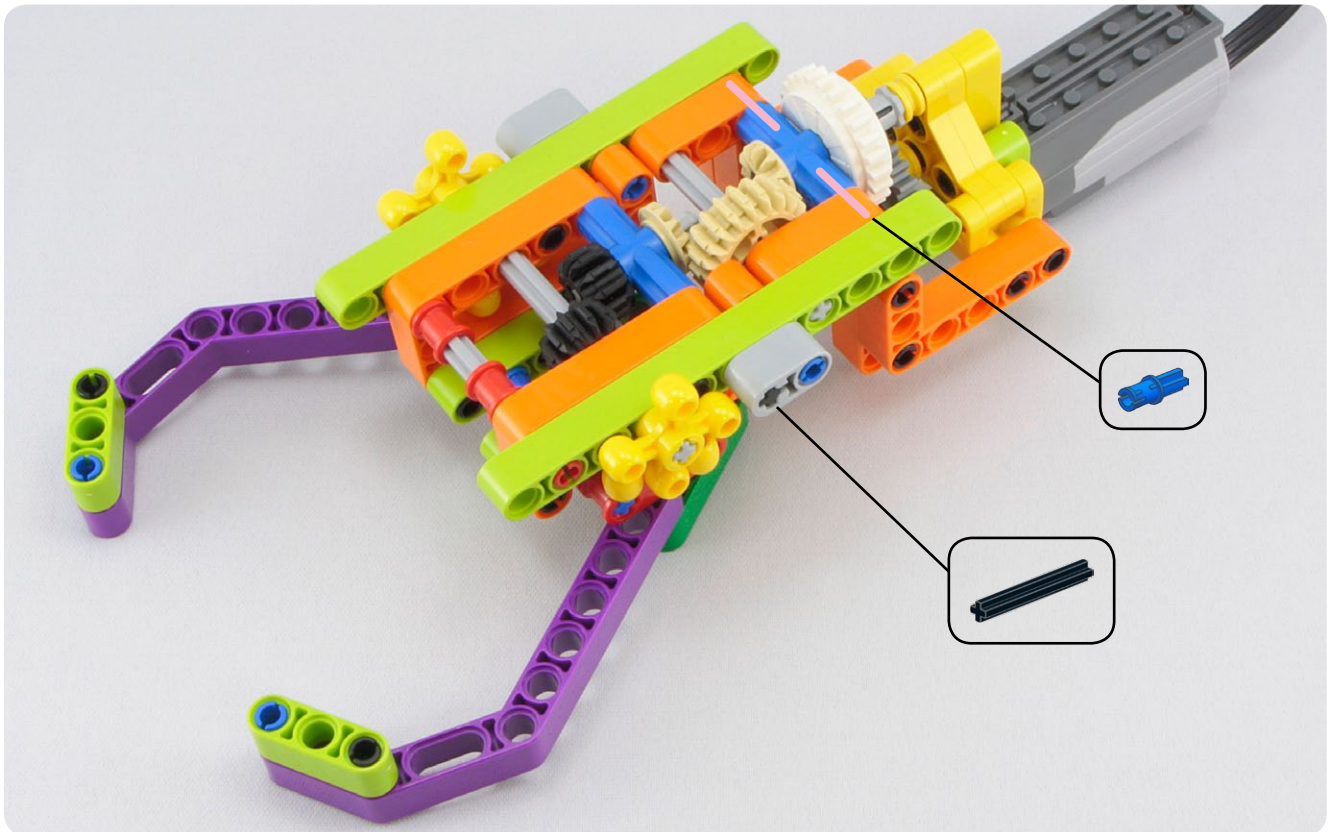
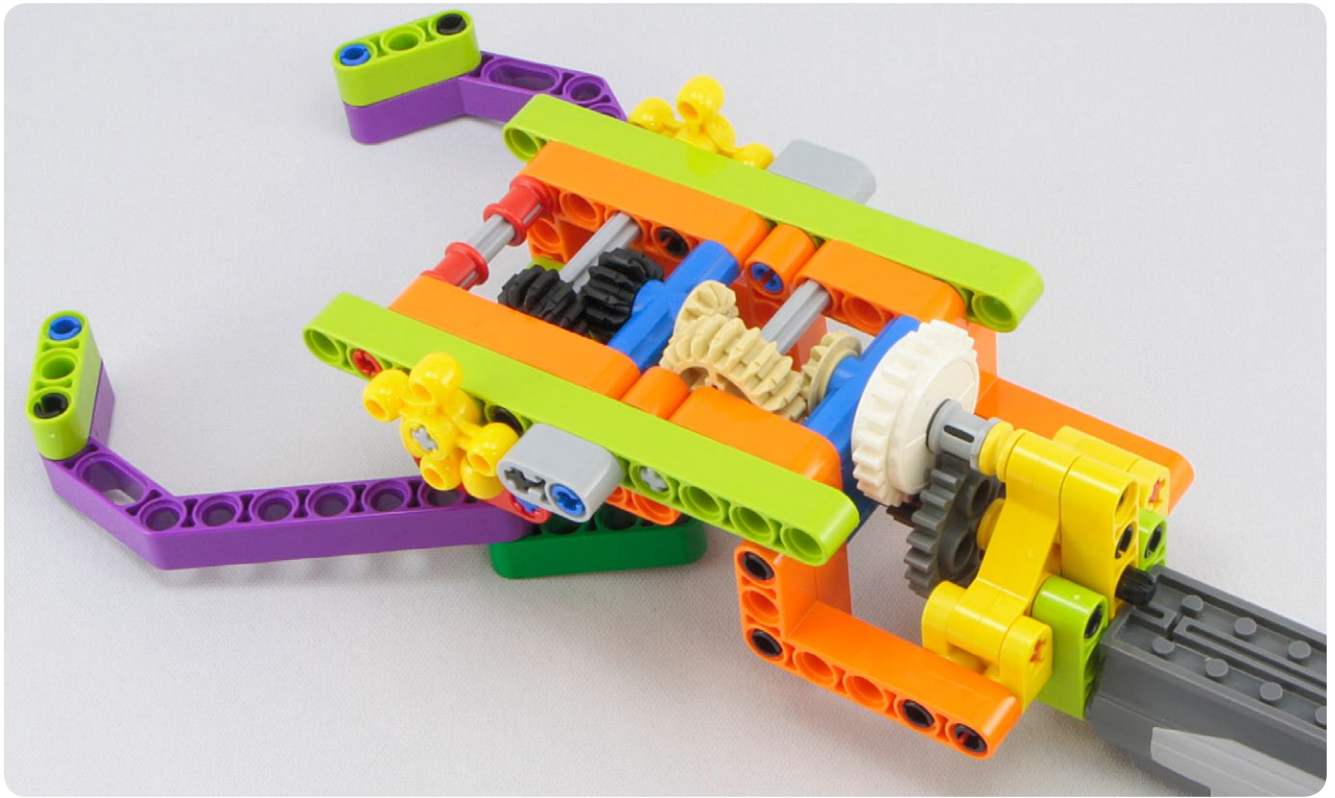


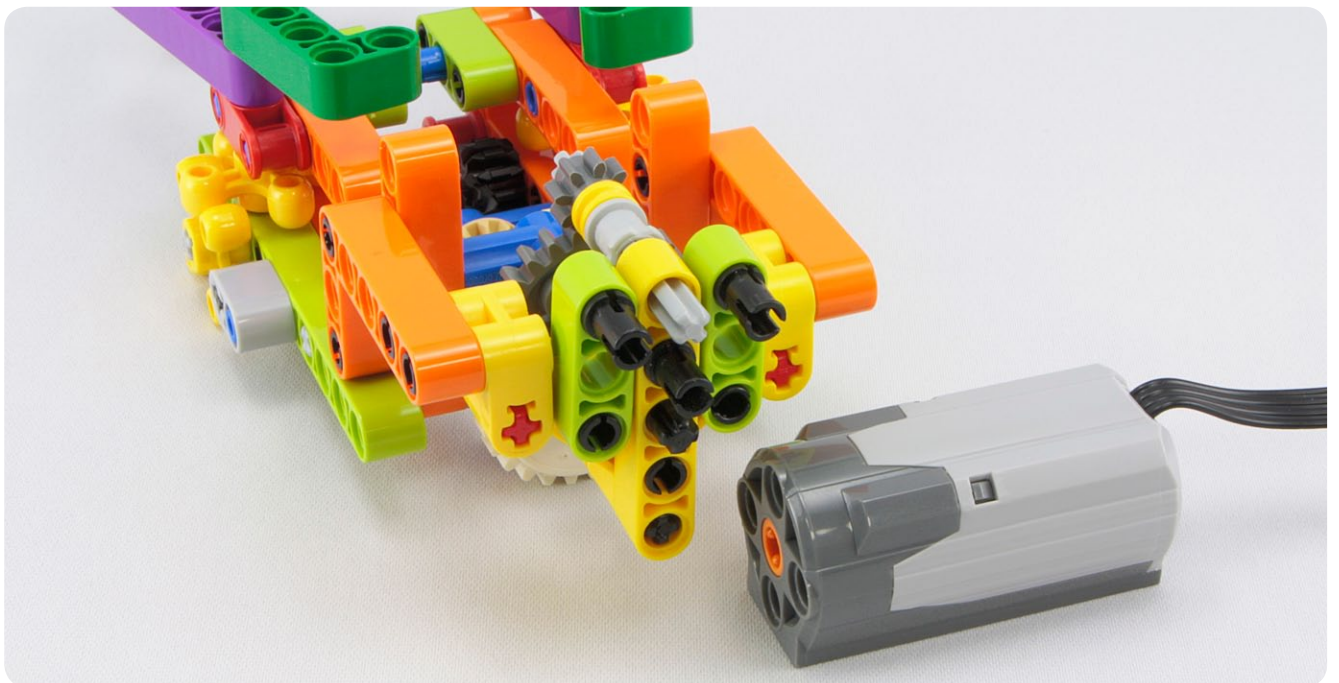
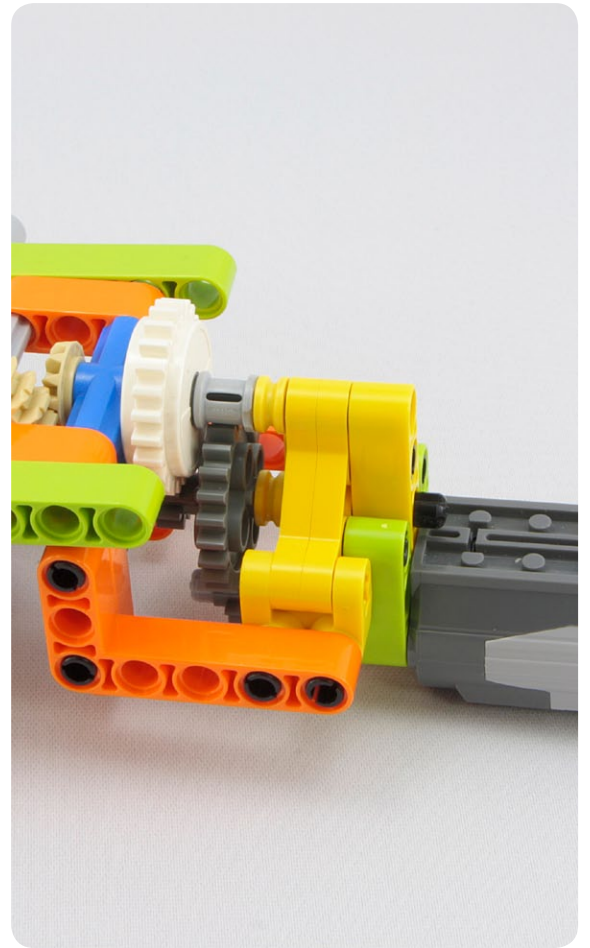
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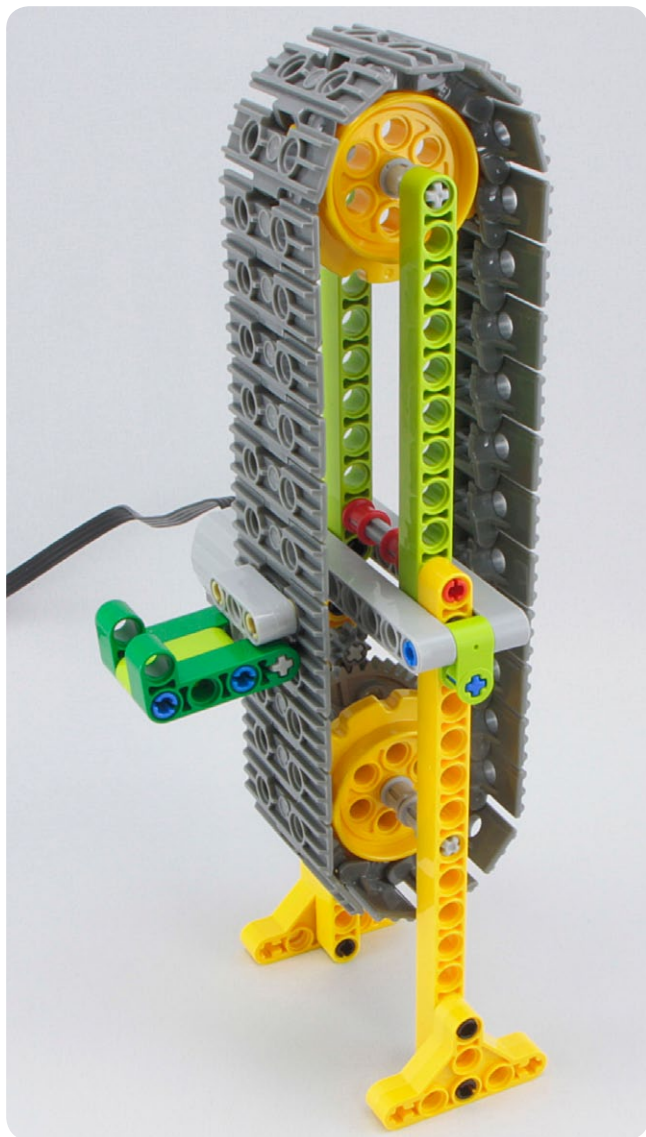
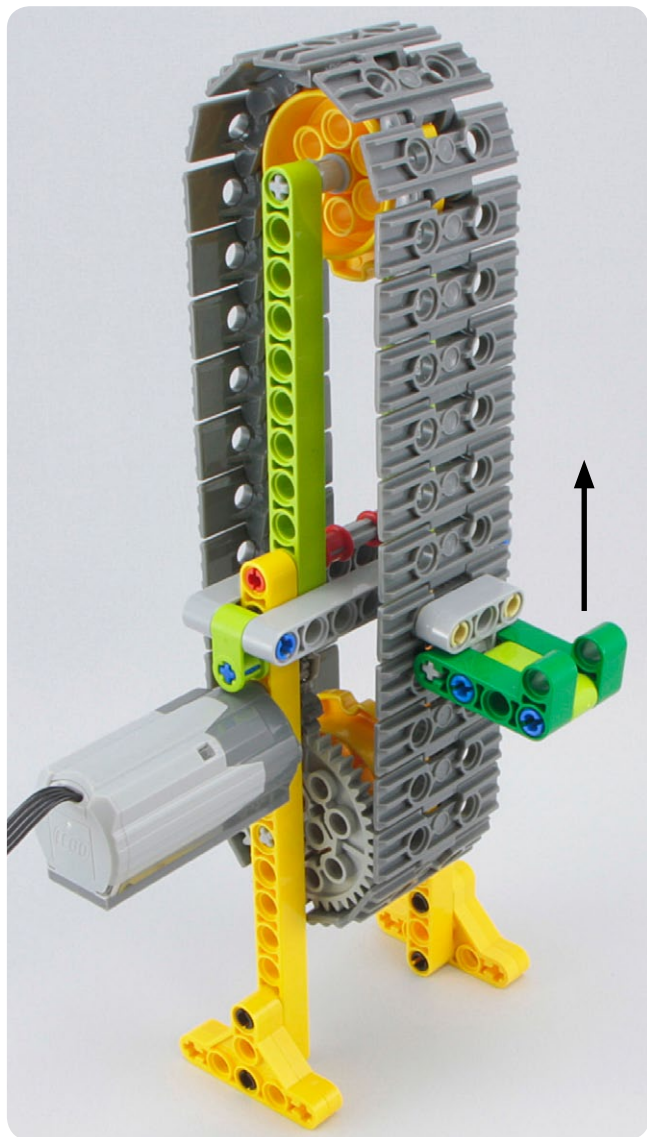
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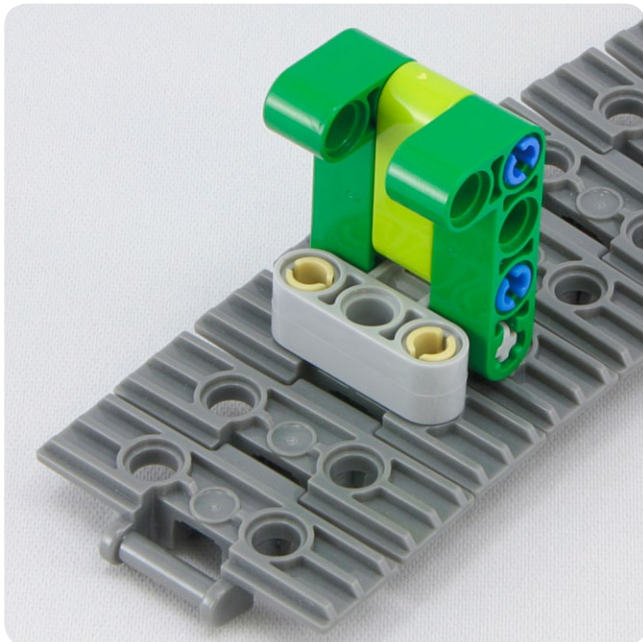
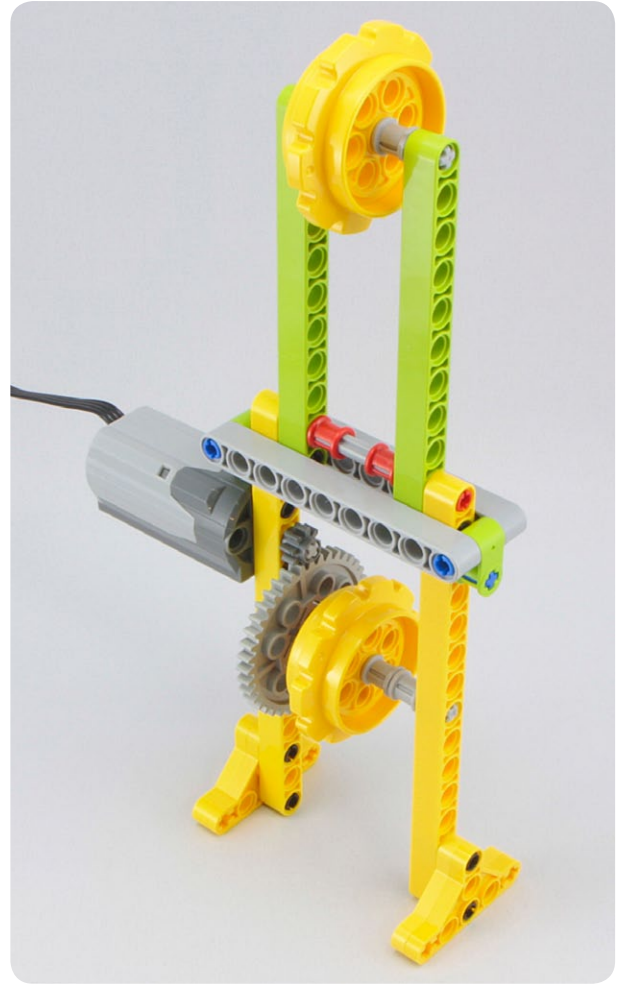


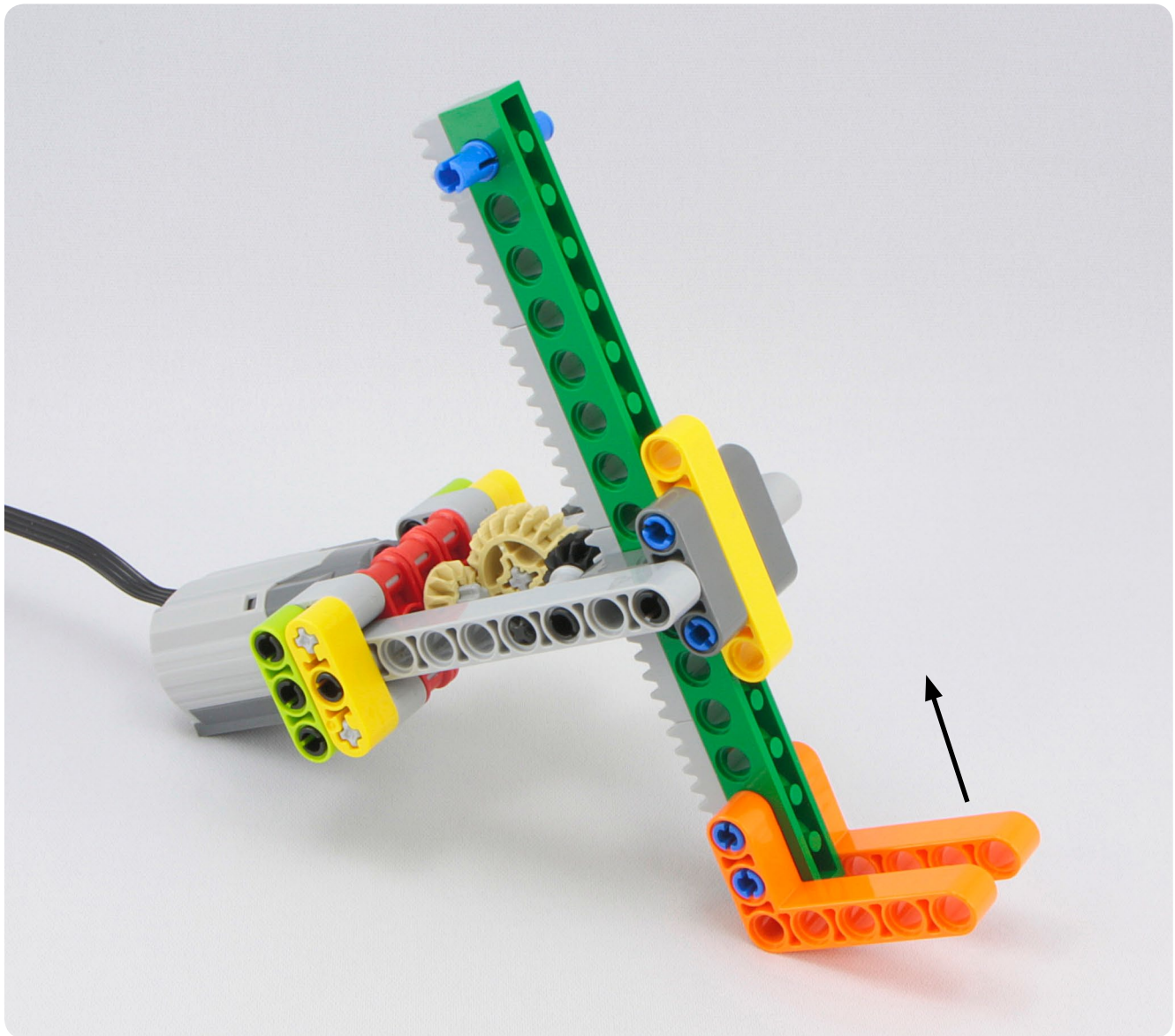


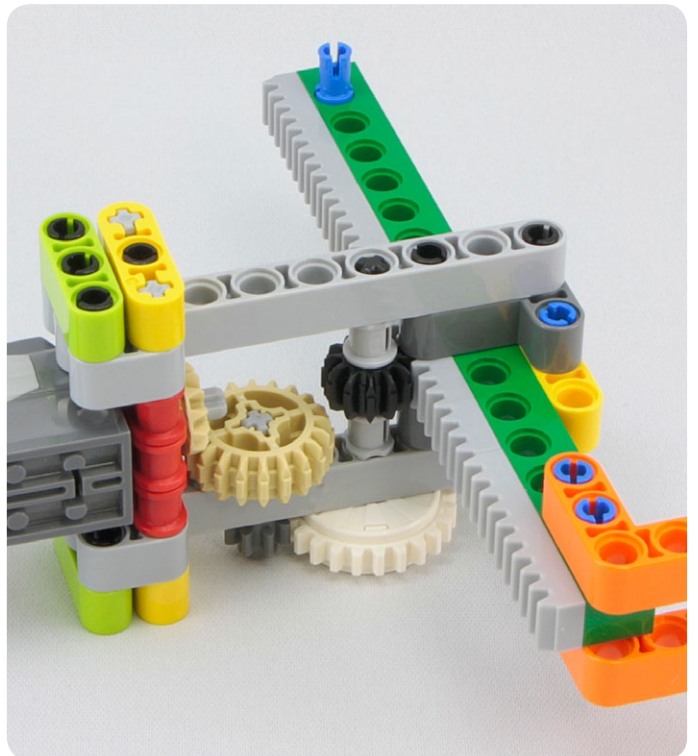
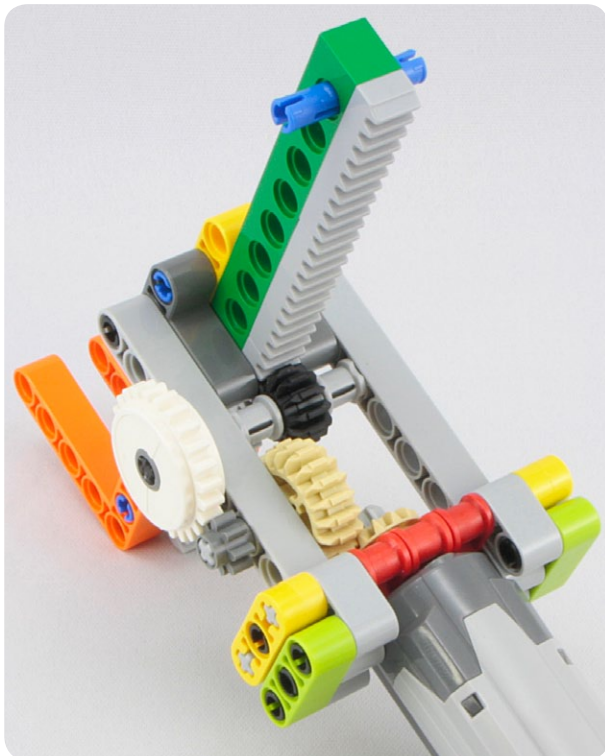
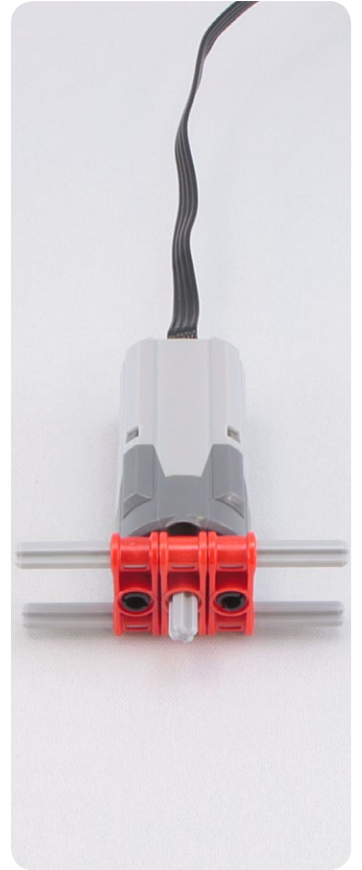
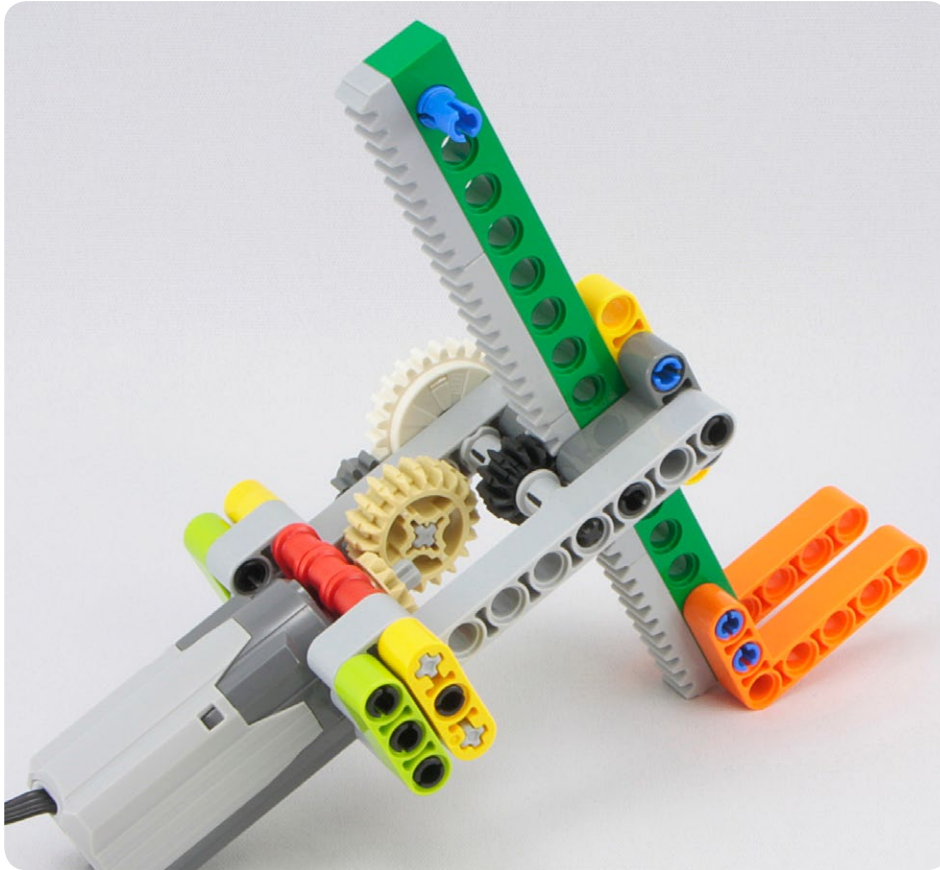




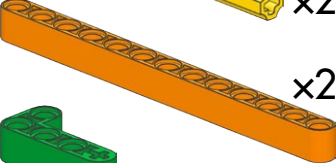
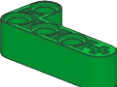
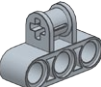
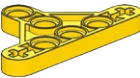
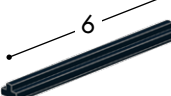
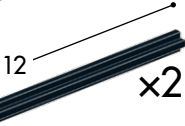
[illegible]

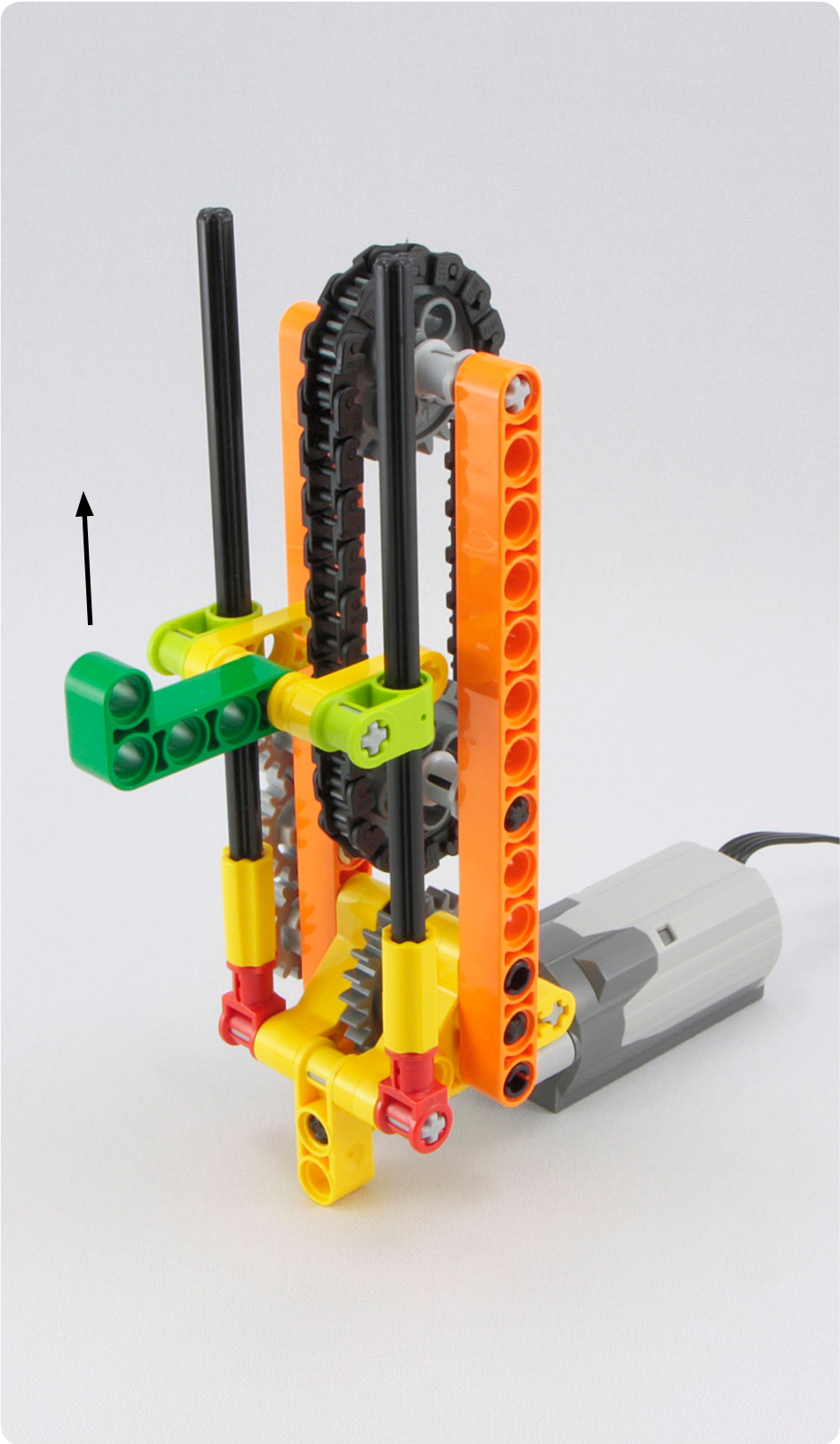


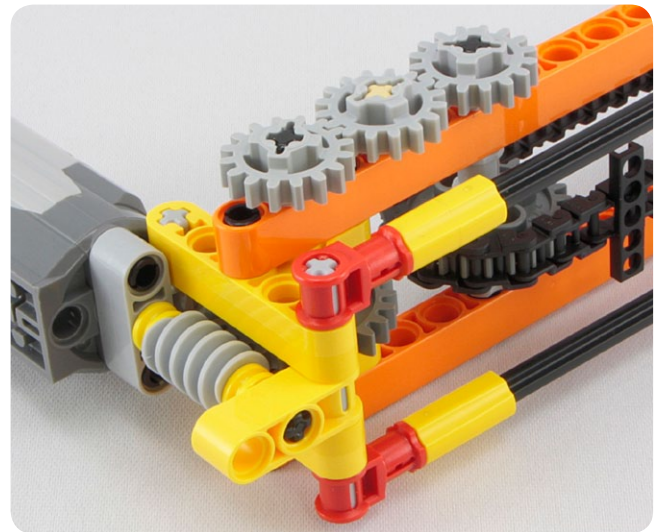
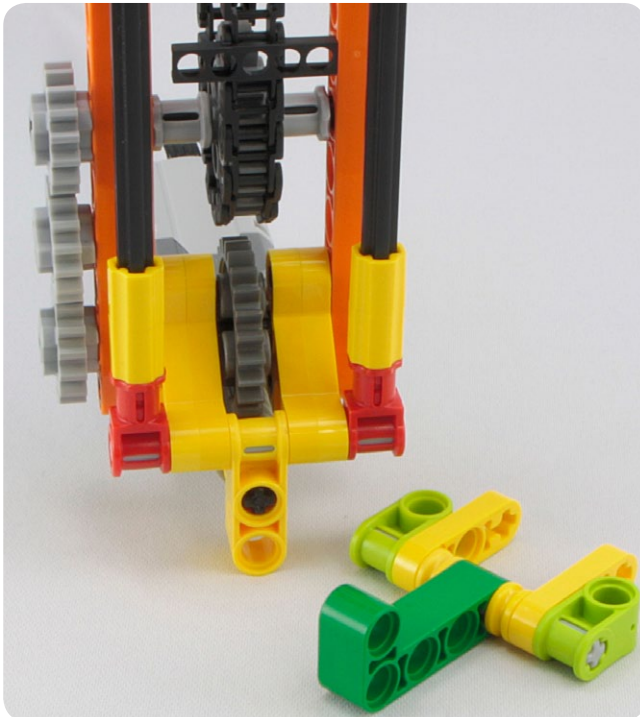
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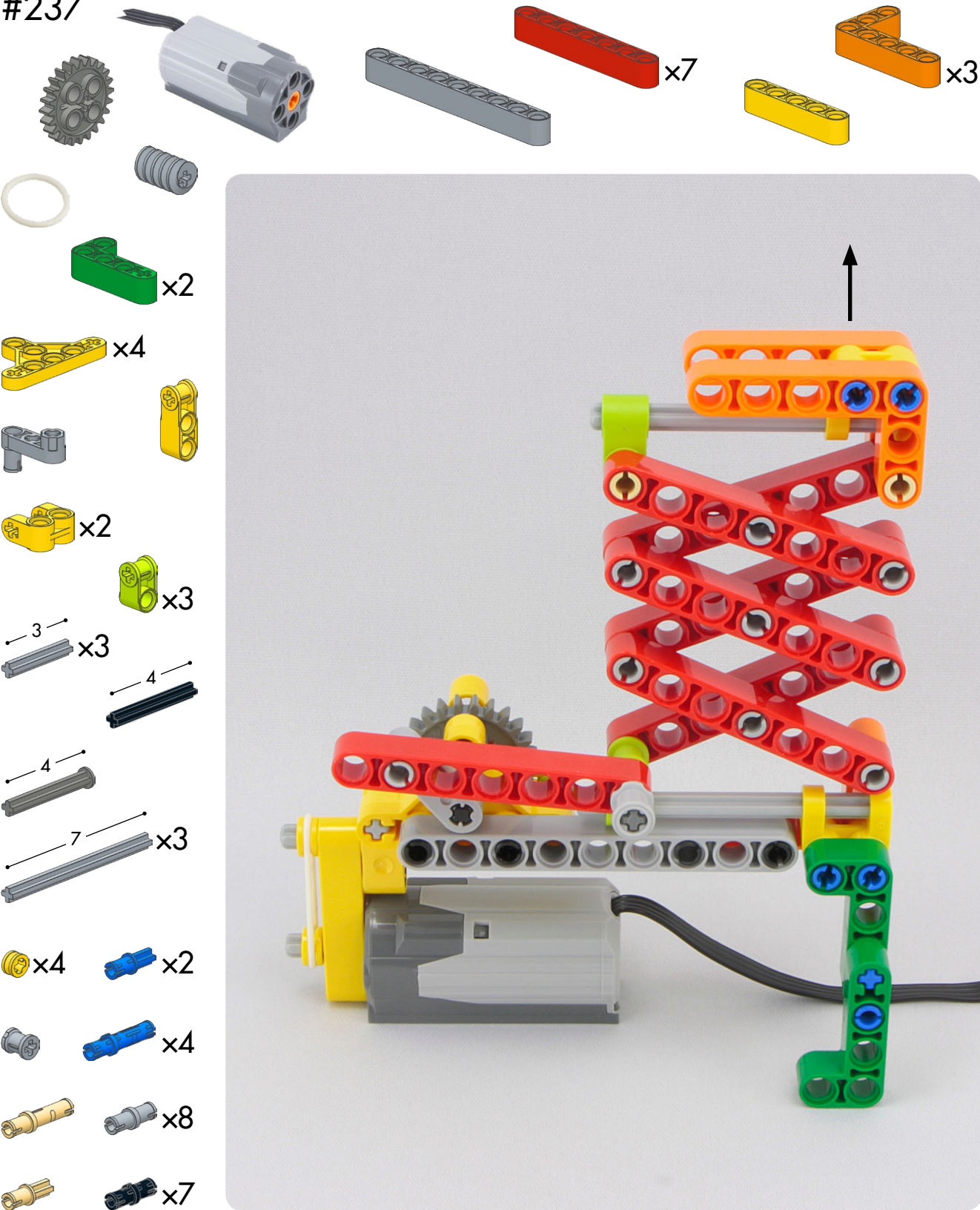
#236

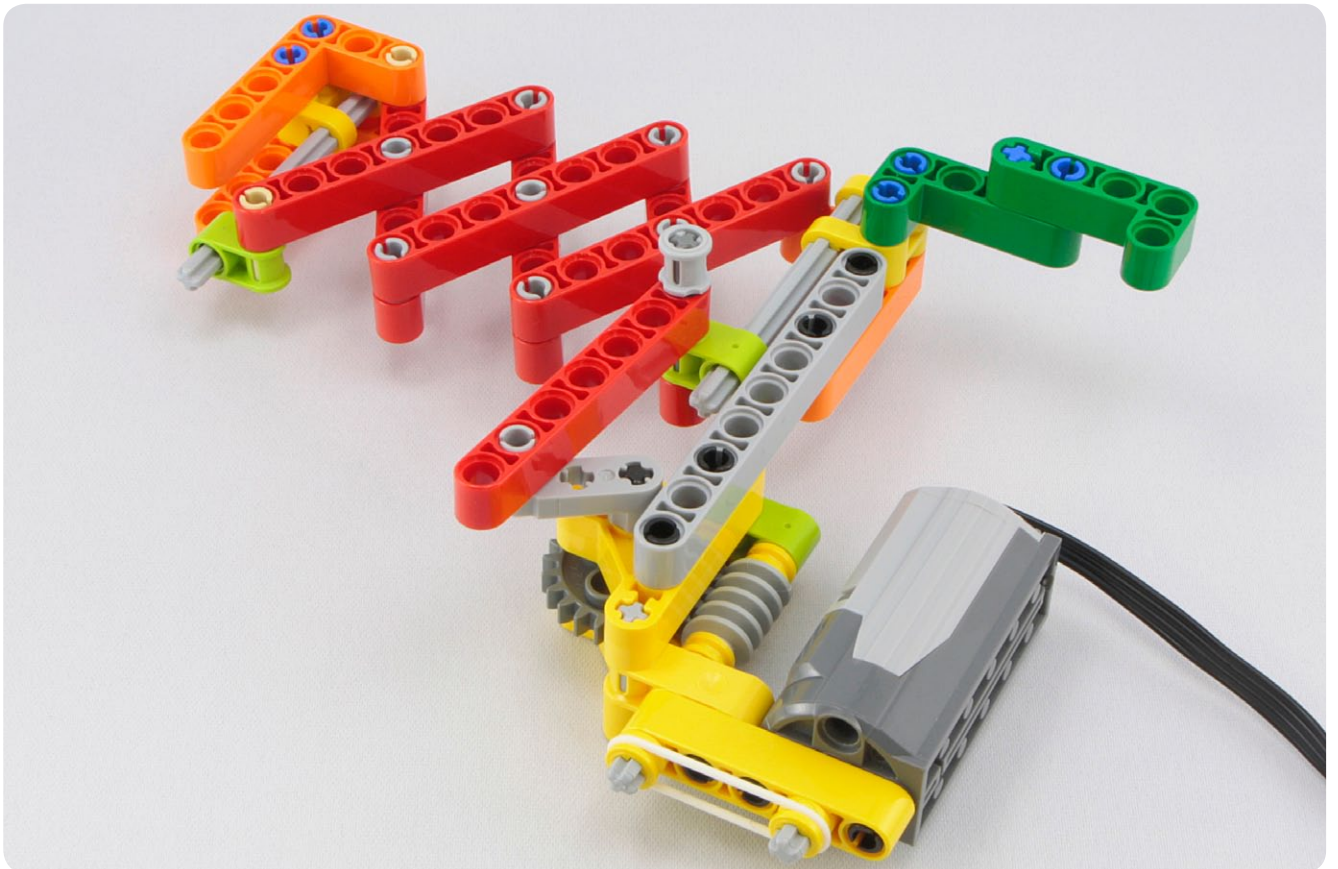
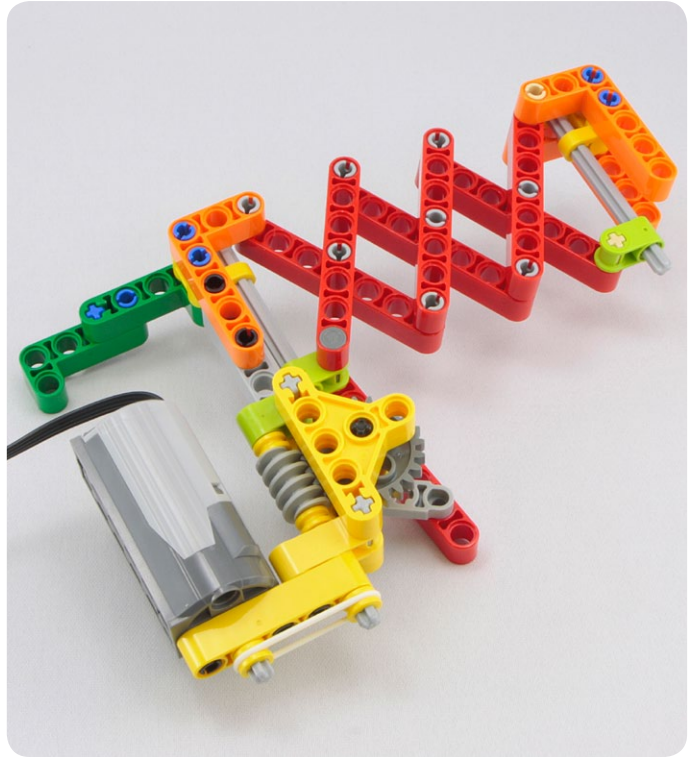
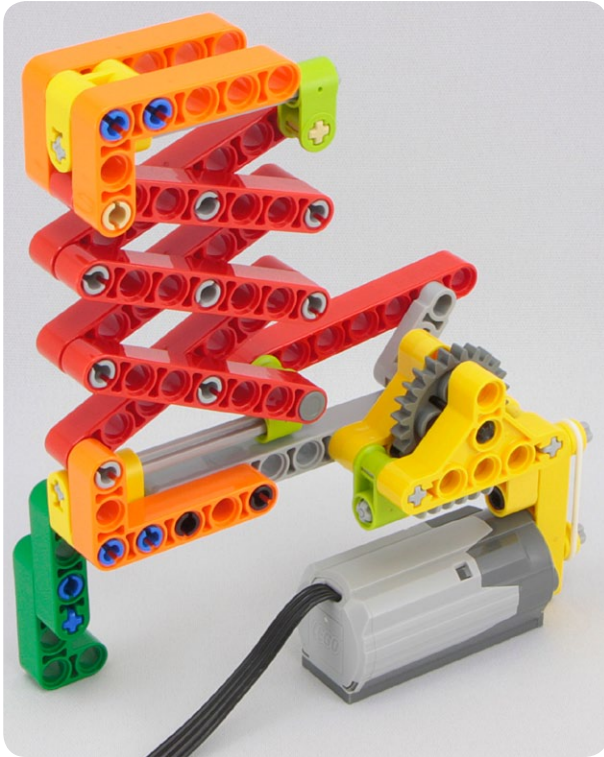
-   x3
-   x3
-  x28 
-  x2  x2
-  x2
-   x2  x2
-  x4  x2
-  x2  x2
-  x3  3
-  x3  12 x2
-  x4  x4
-   x6

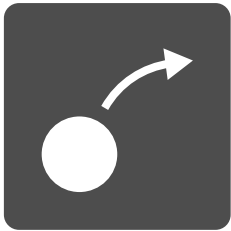




#237





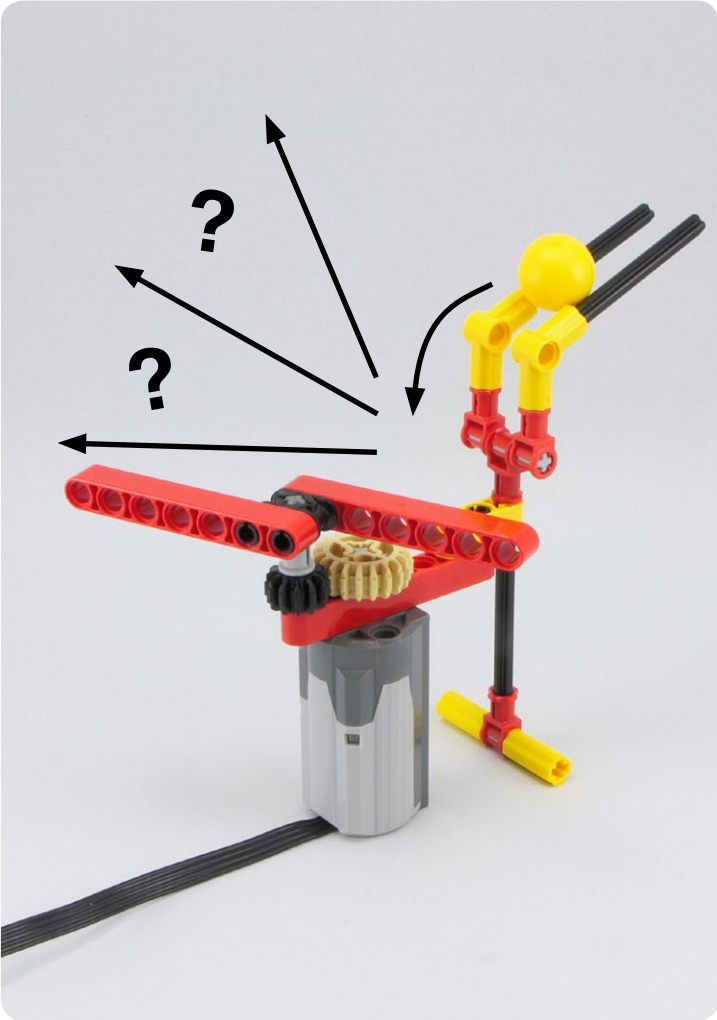


Shooting things

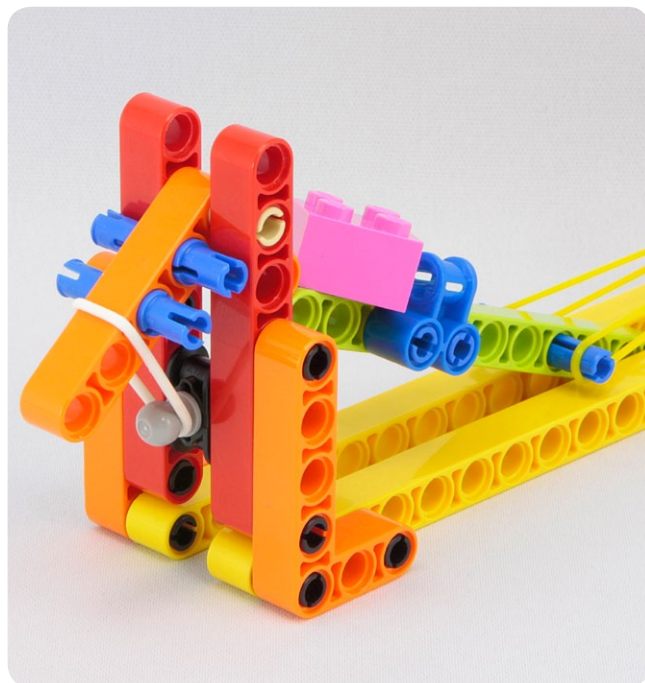
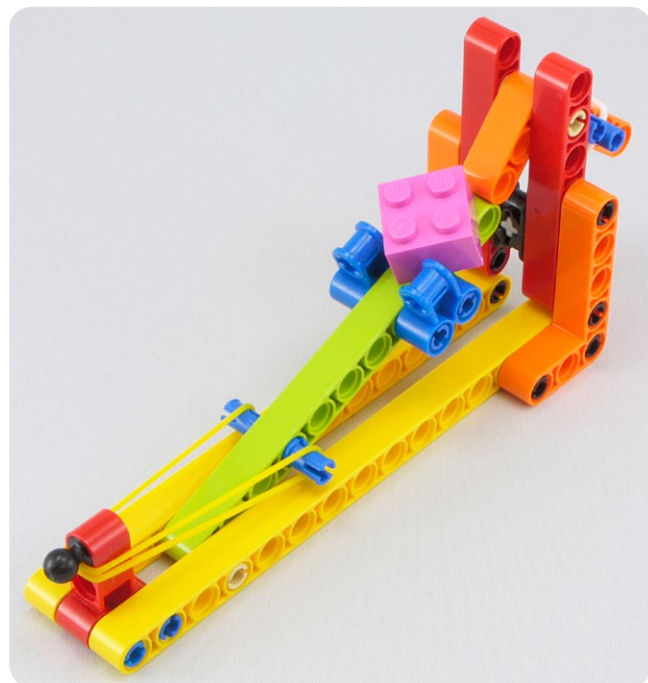
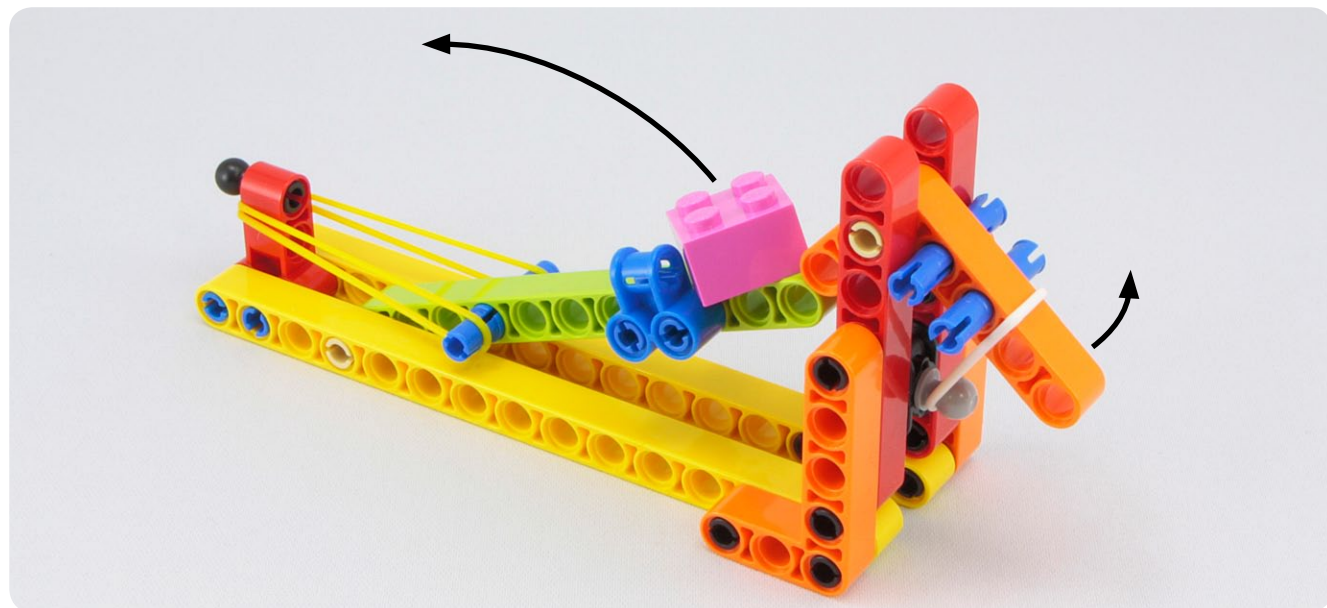
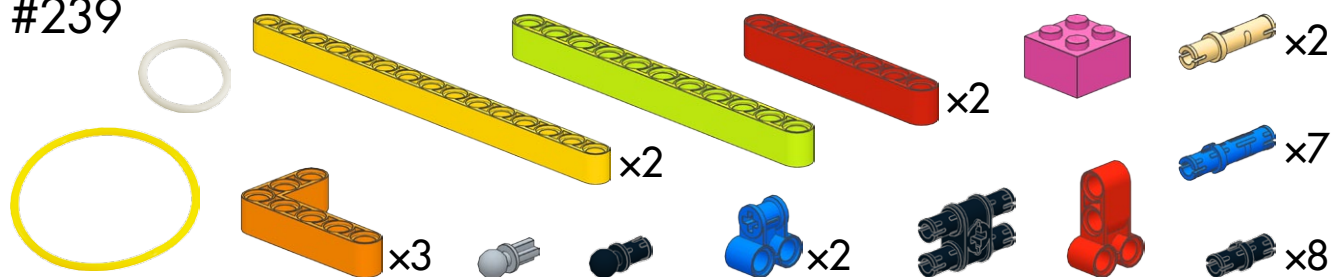
#238

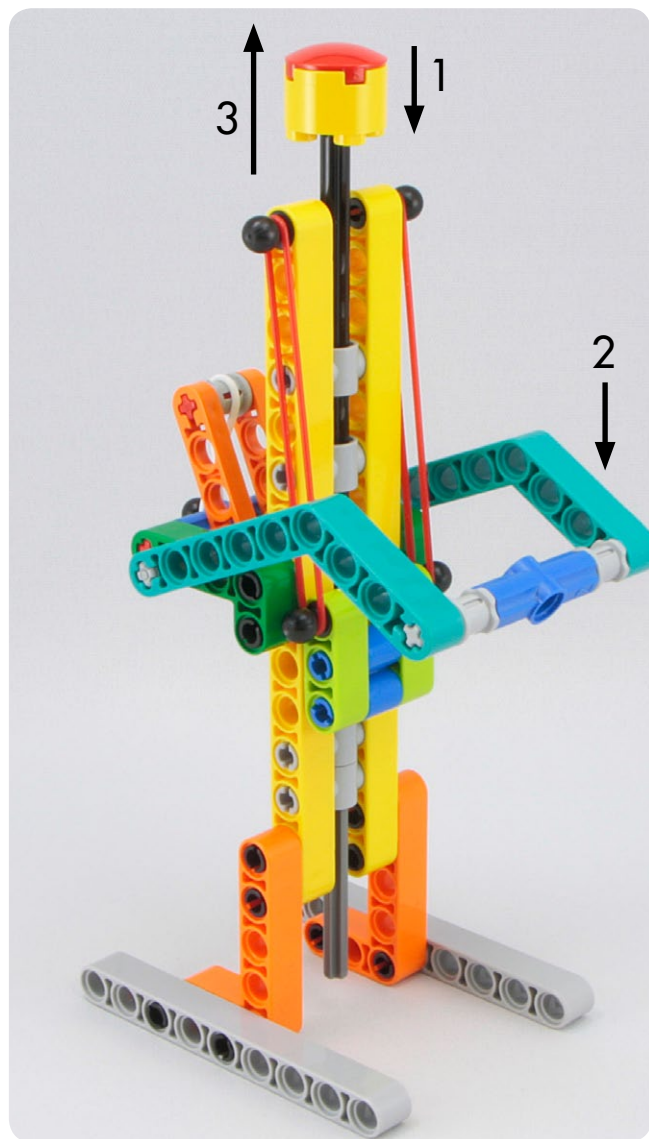
Parts list for step 238:

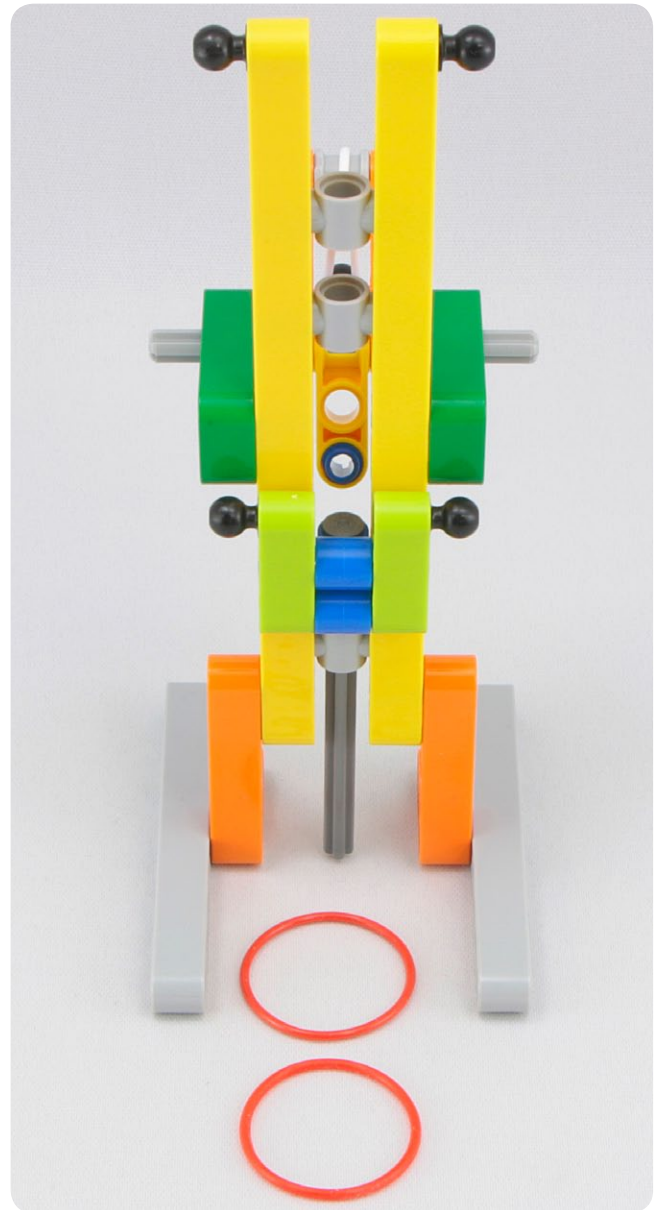
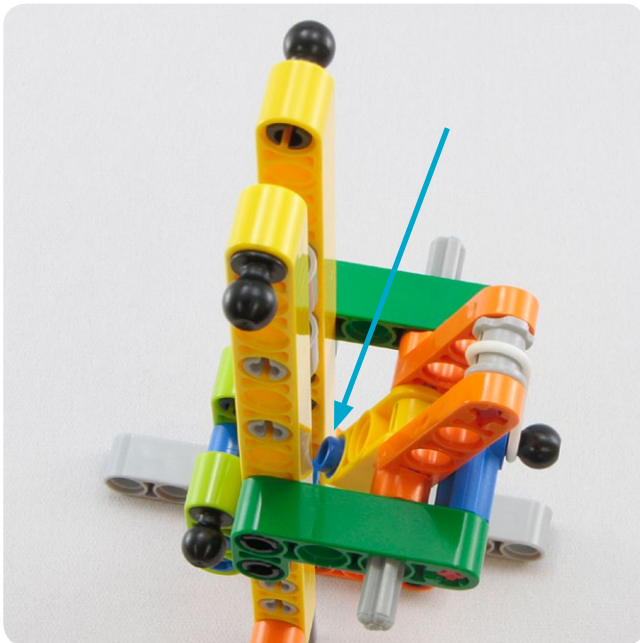
- 1x 12-tooth yellow gear
- 1x 12-tooth black gear
- 1x Yellow sphere
- 2x Yellow L-shaped connectors
- 3x Red 1x6 Technic beam
- 2x Yellow 1x3 Technic beam
- 2x Yellow 1x2 Technic beam
- 3x Black 1x3 Technic beam
- 4x Red 1x2 Technic connector
- 2x Red 1x1 Technic connector
- 3x Grey 1x3 Technic beam
- 2x Grey 1x6 Technic beam
- 2x Grey 1x8 Technic beam
- 3x Blue 1x2 Technic connector
- 3x Black 1x2 Technic connector
- 1x Grey 1x2 Technic connector
- 1x Grey 1x1 Technic connector

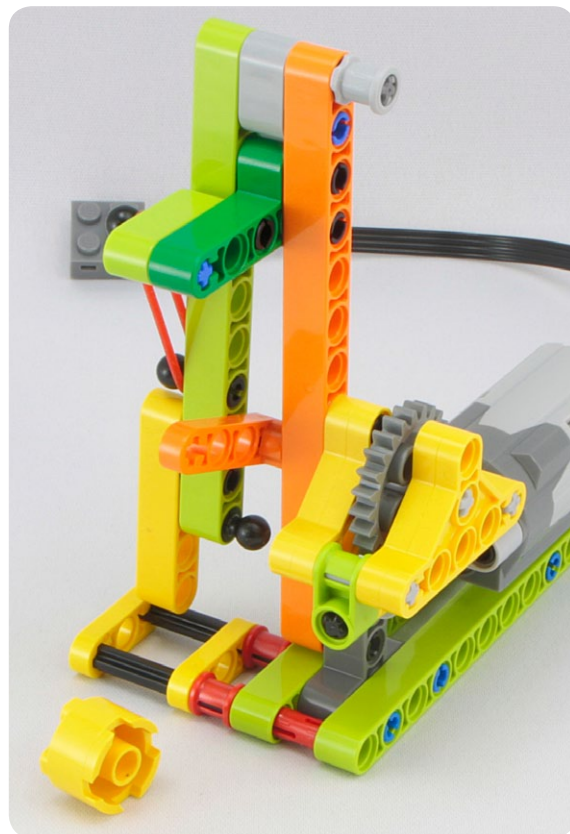
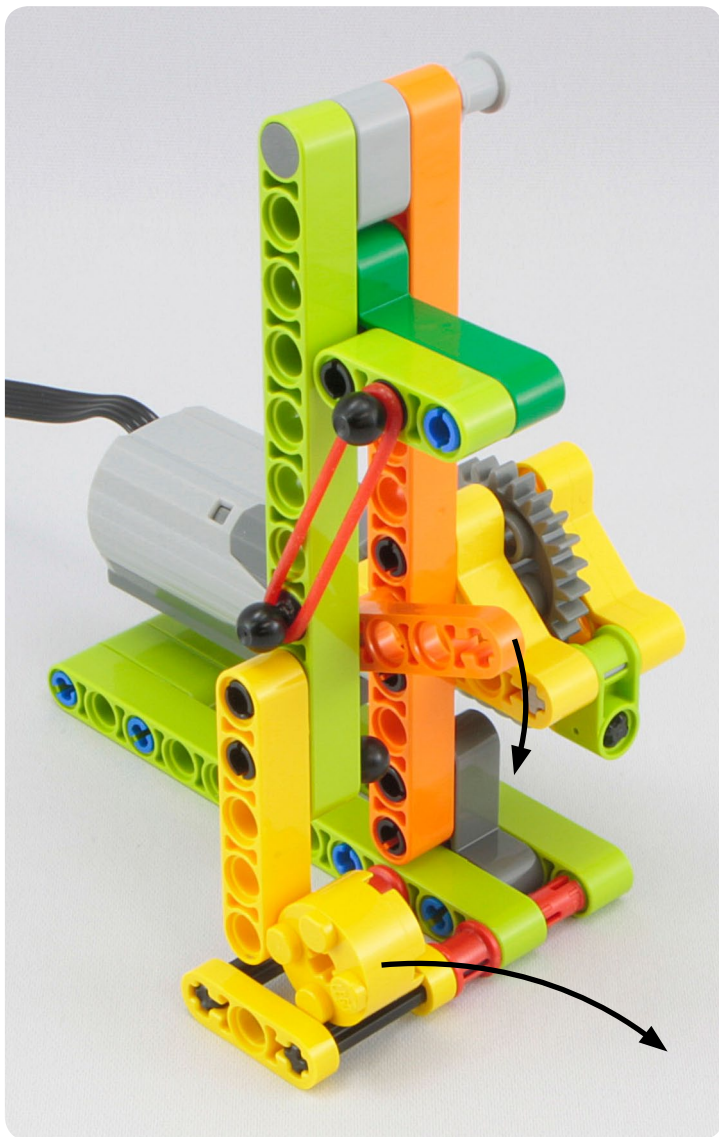


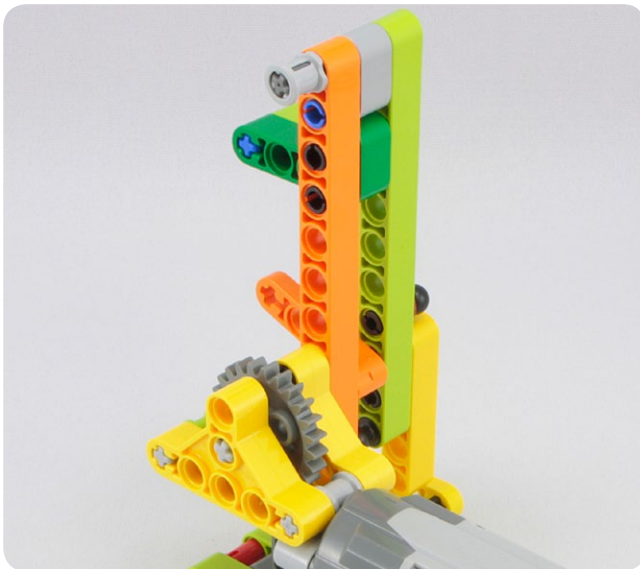
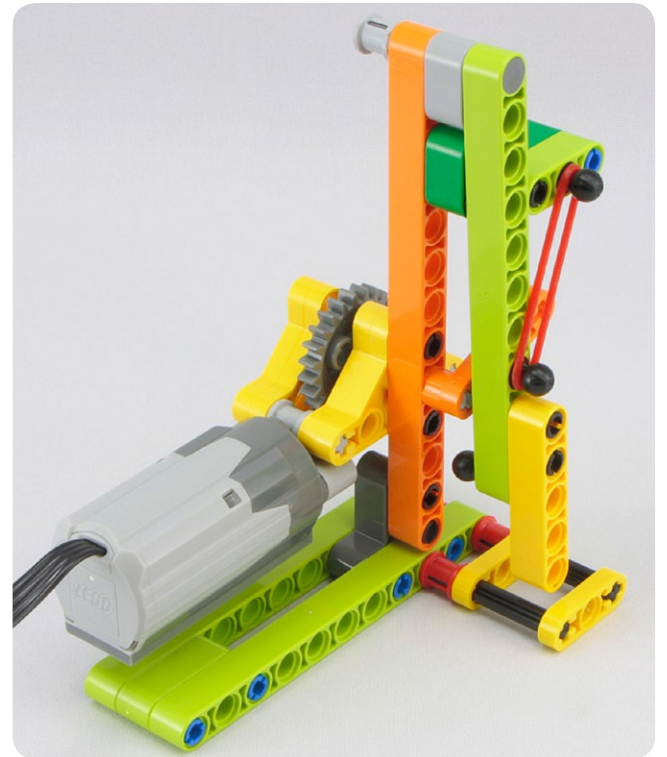
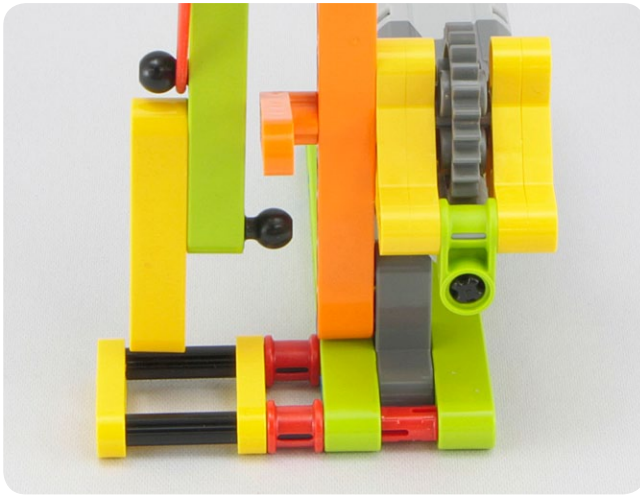
#239

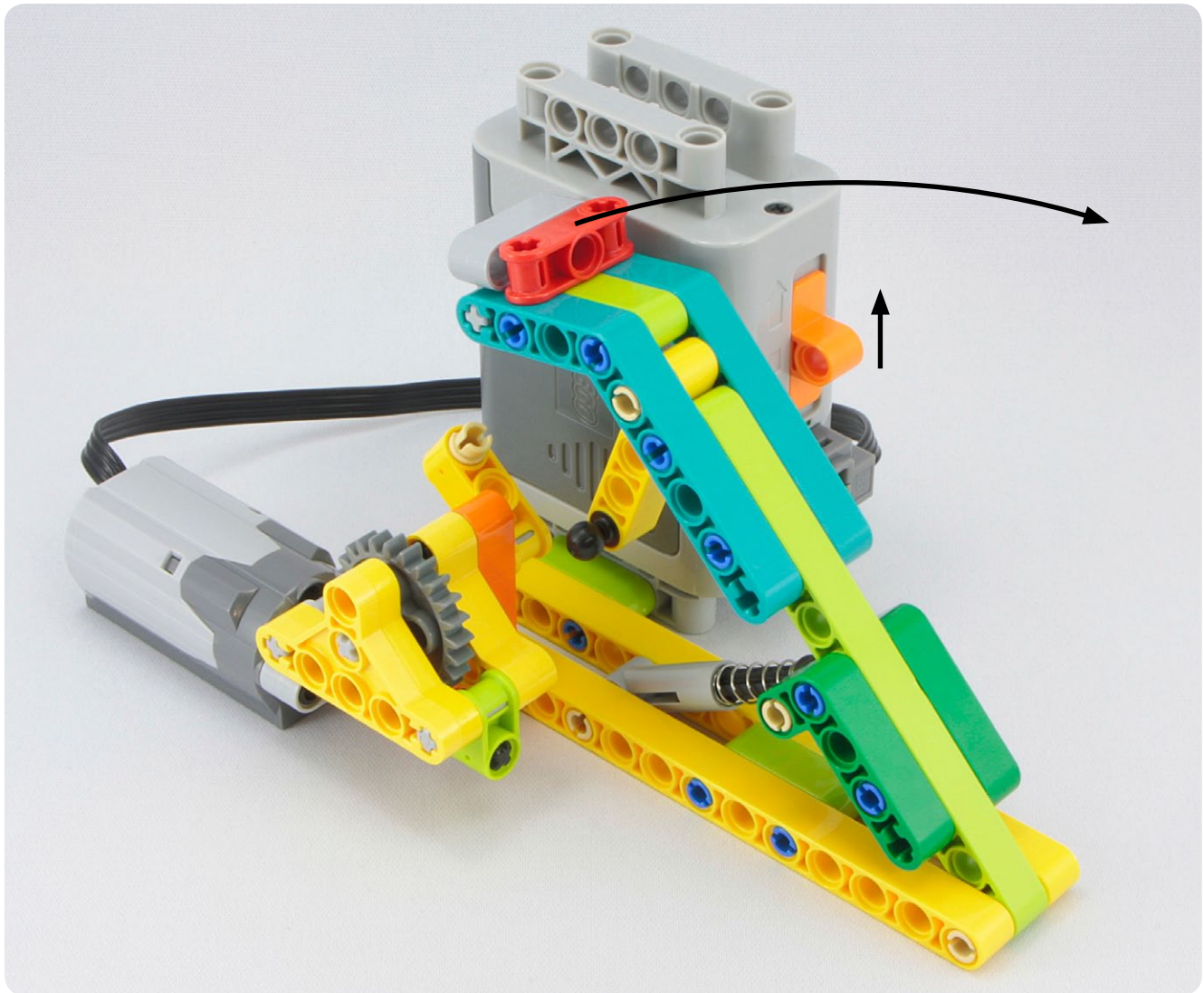


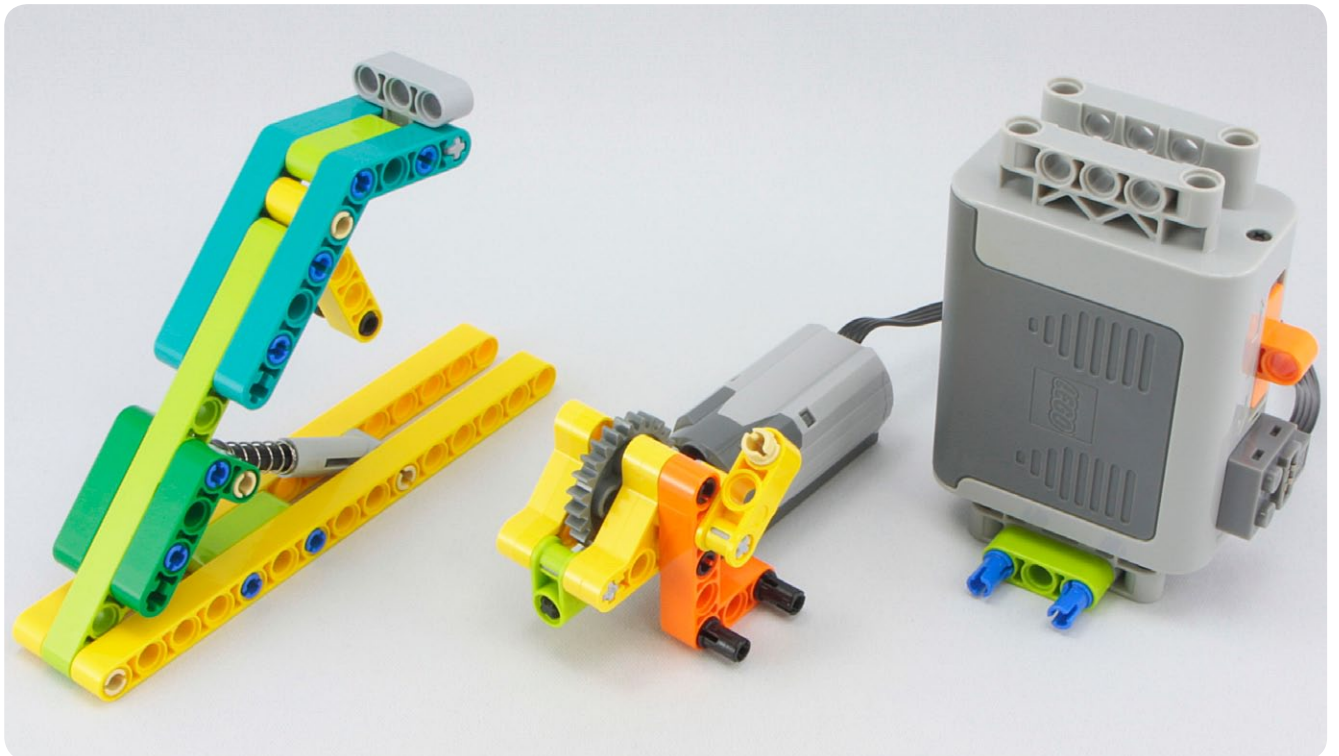
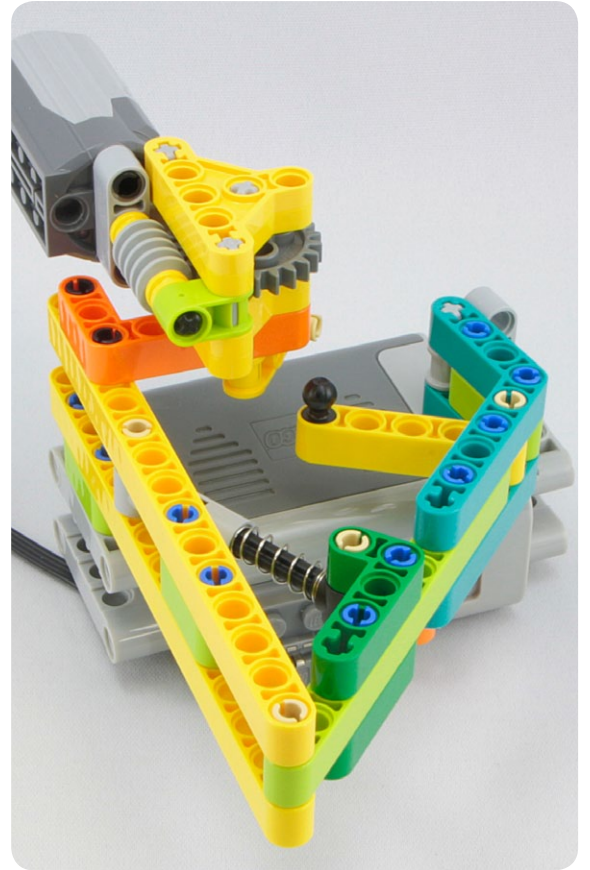
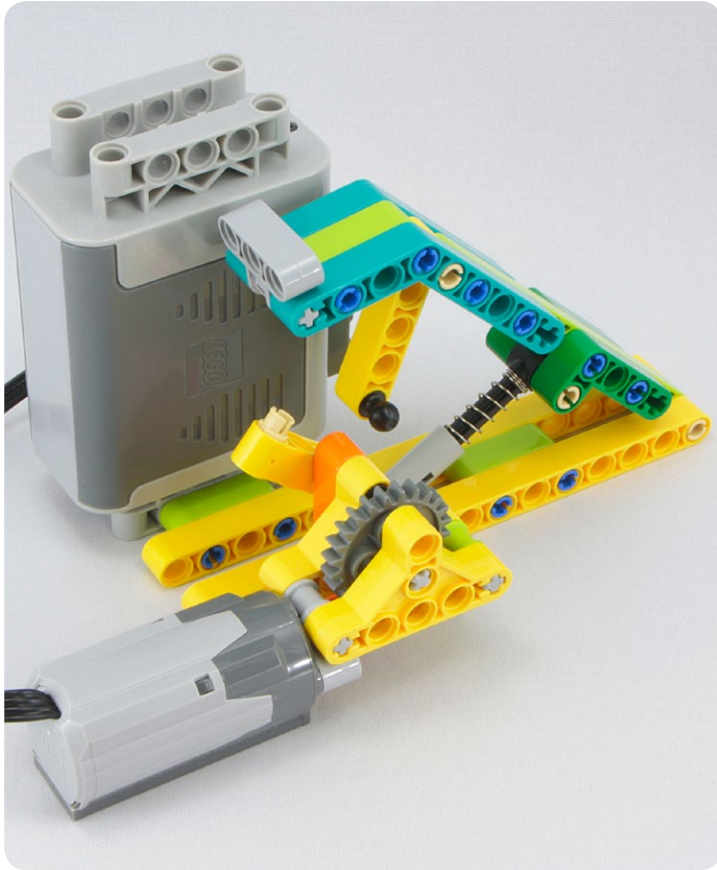
[illegible]

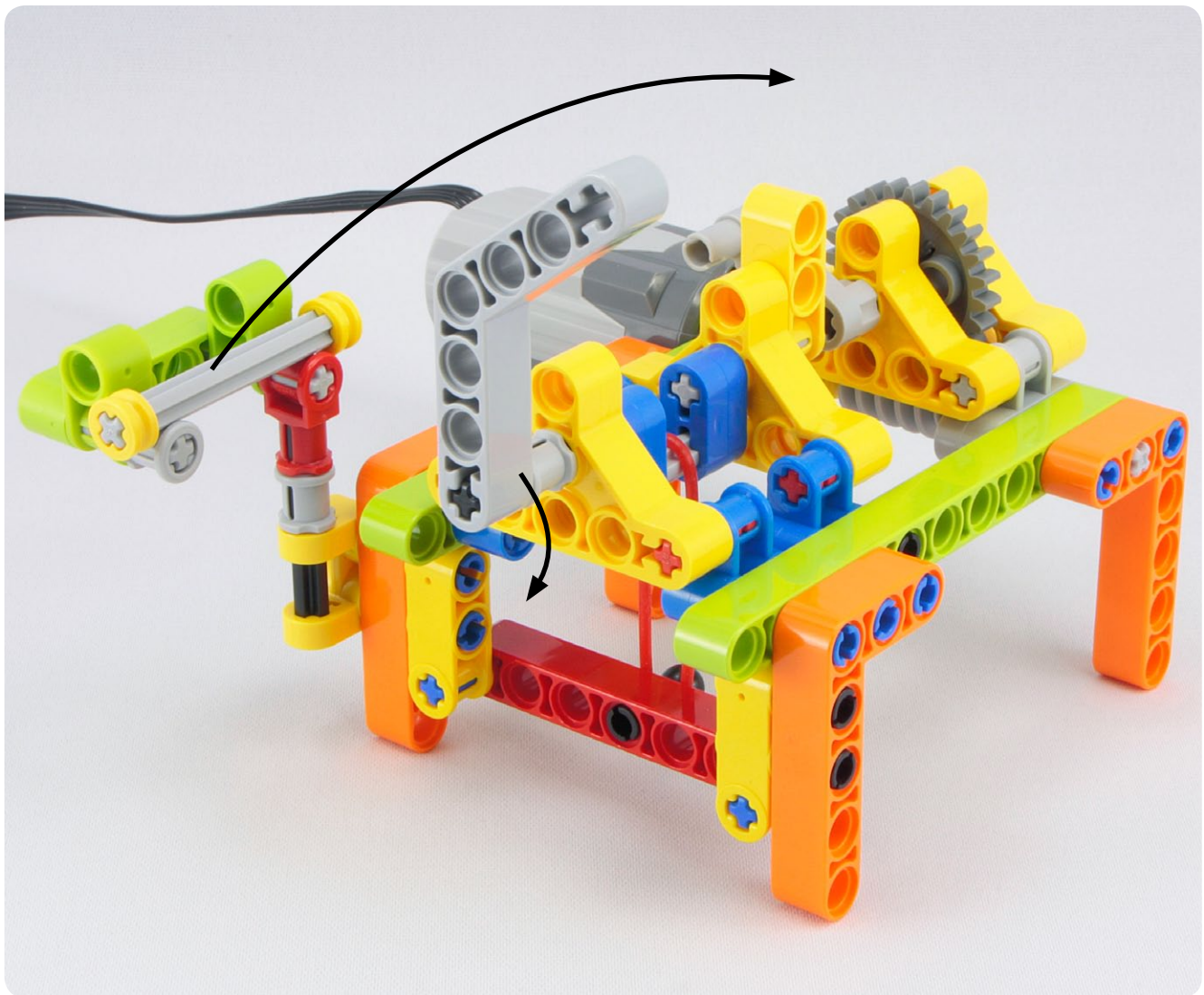


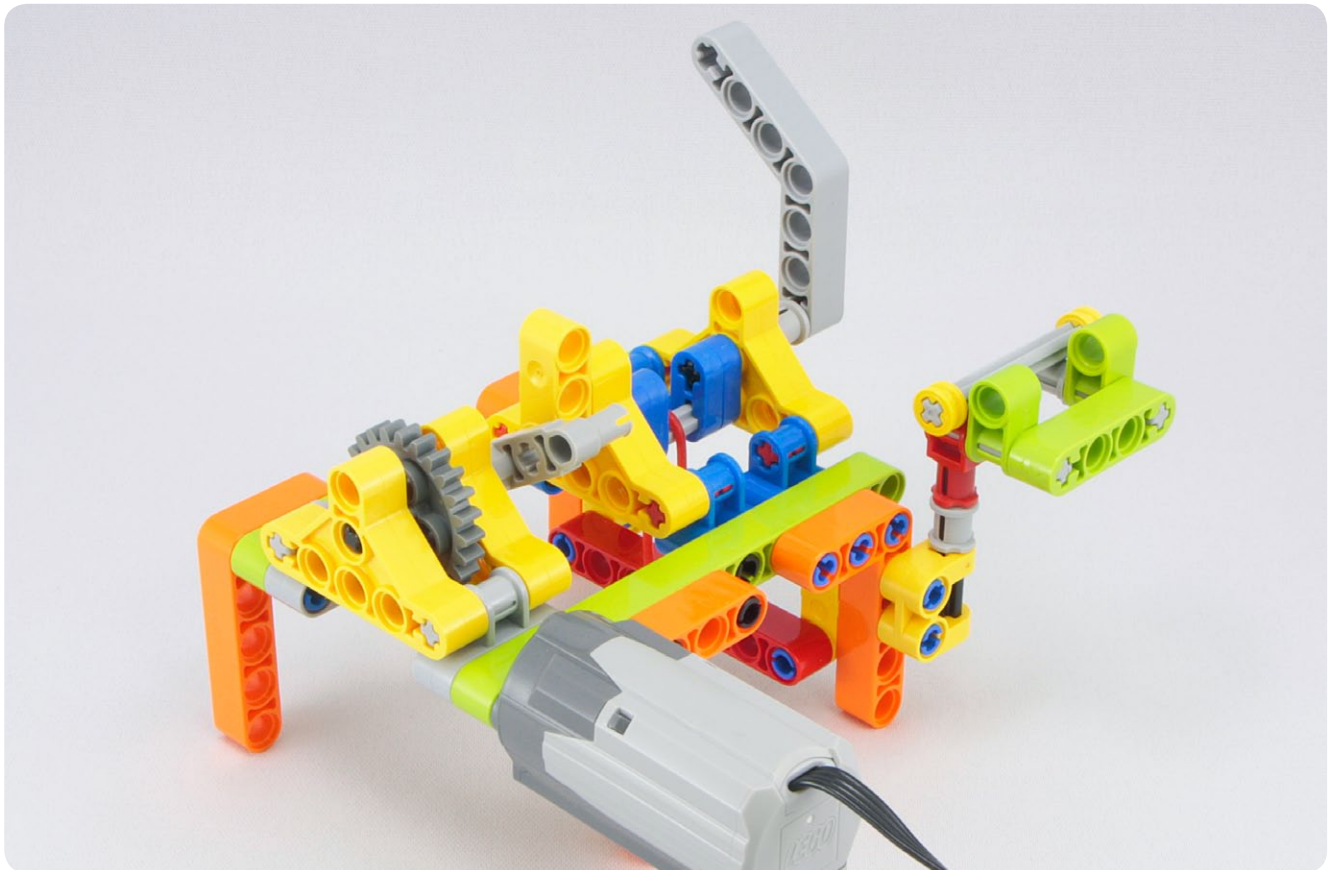
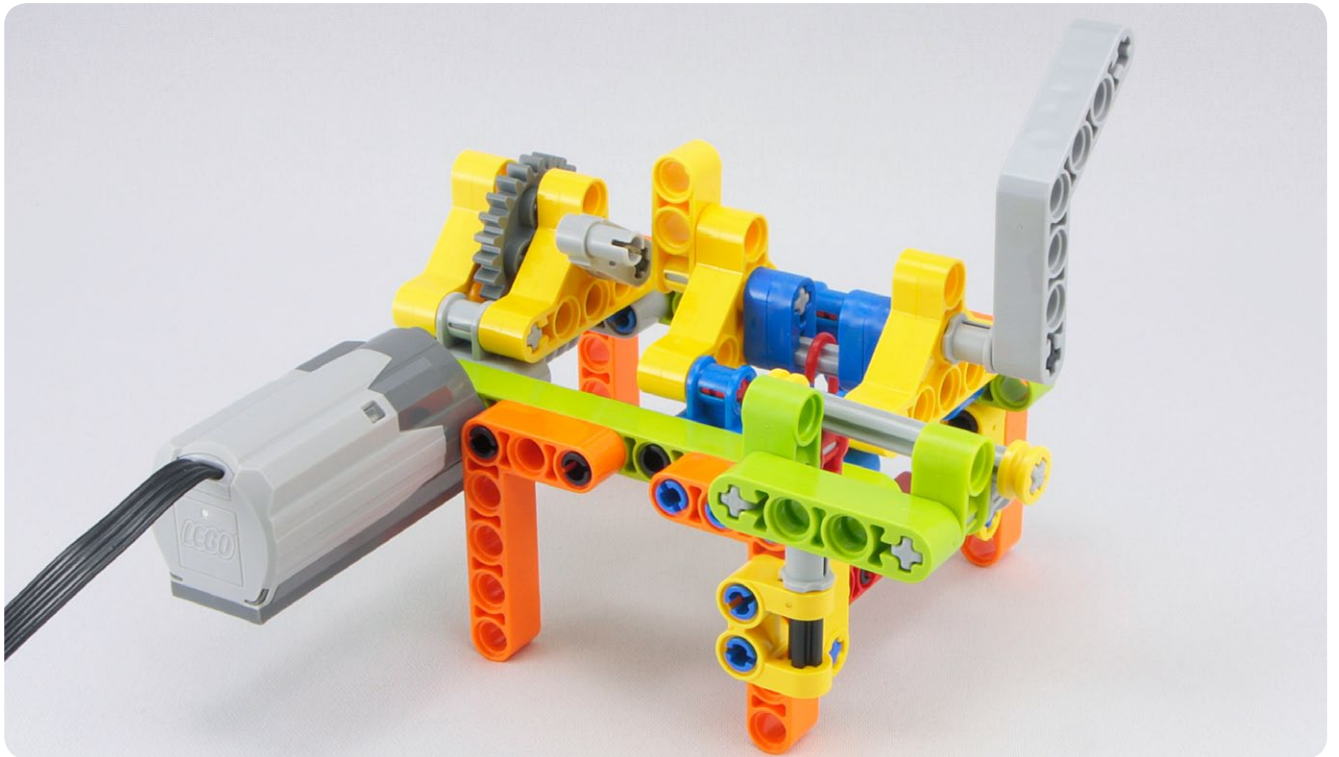


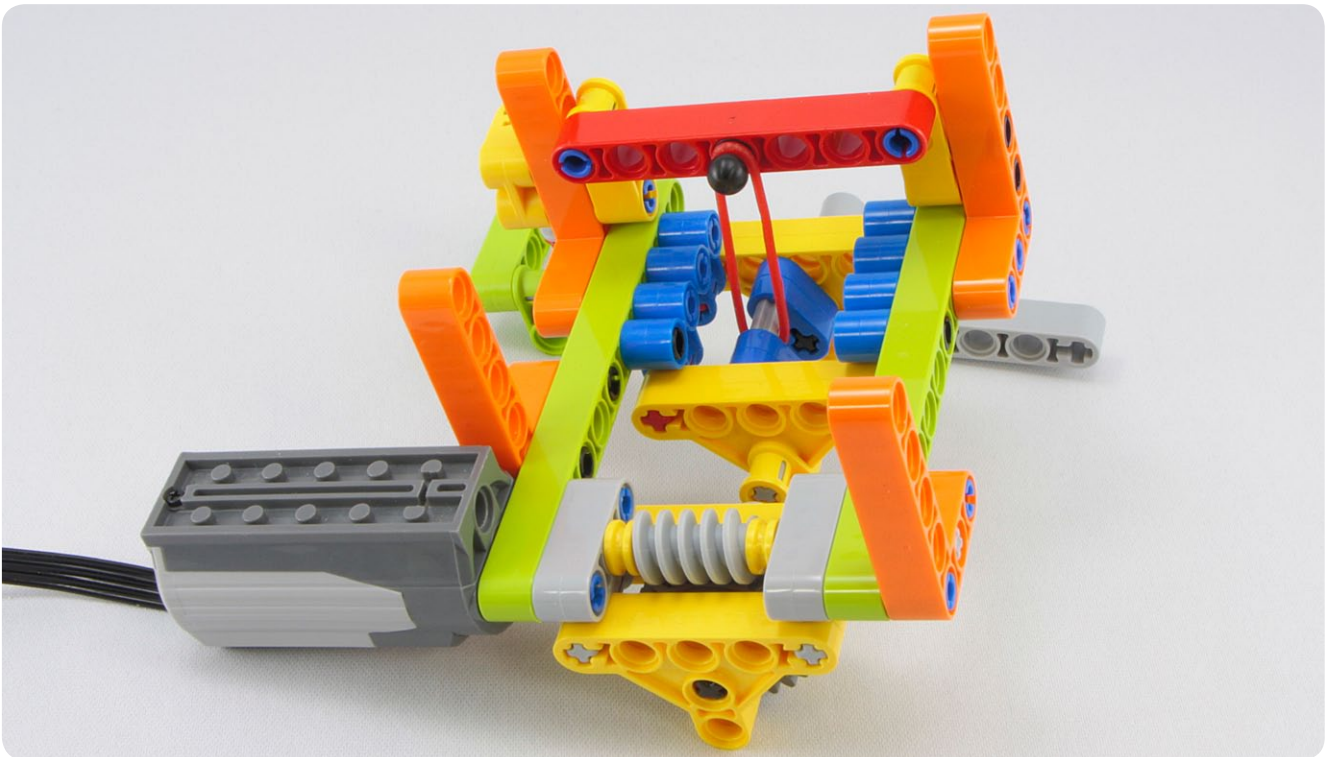
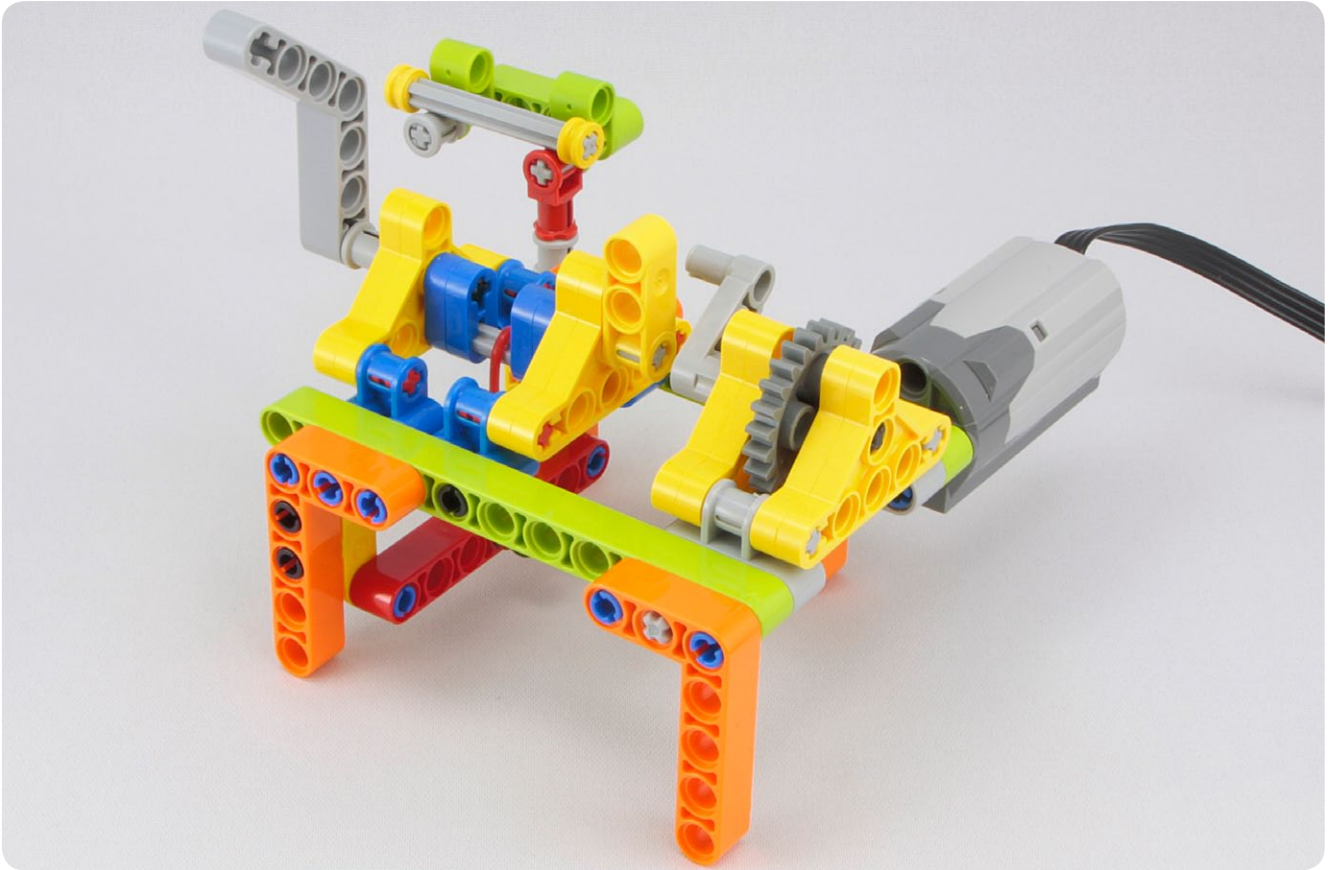


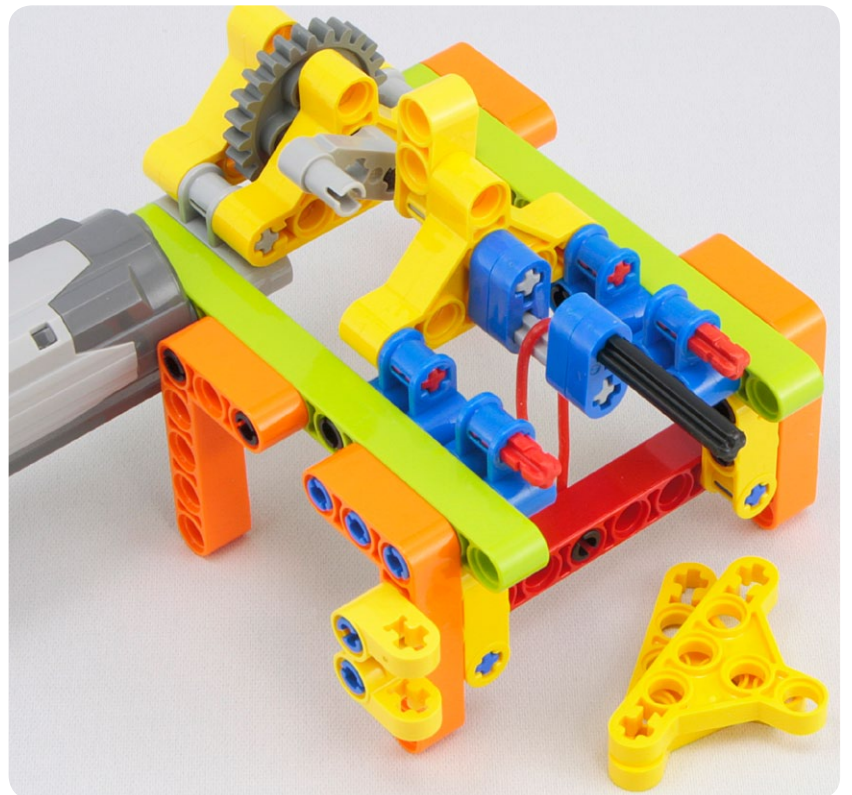
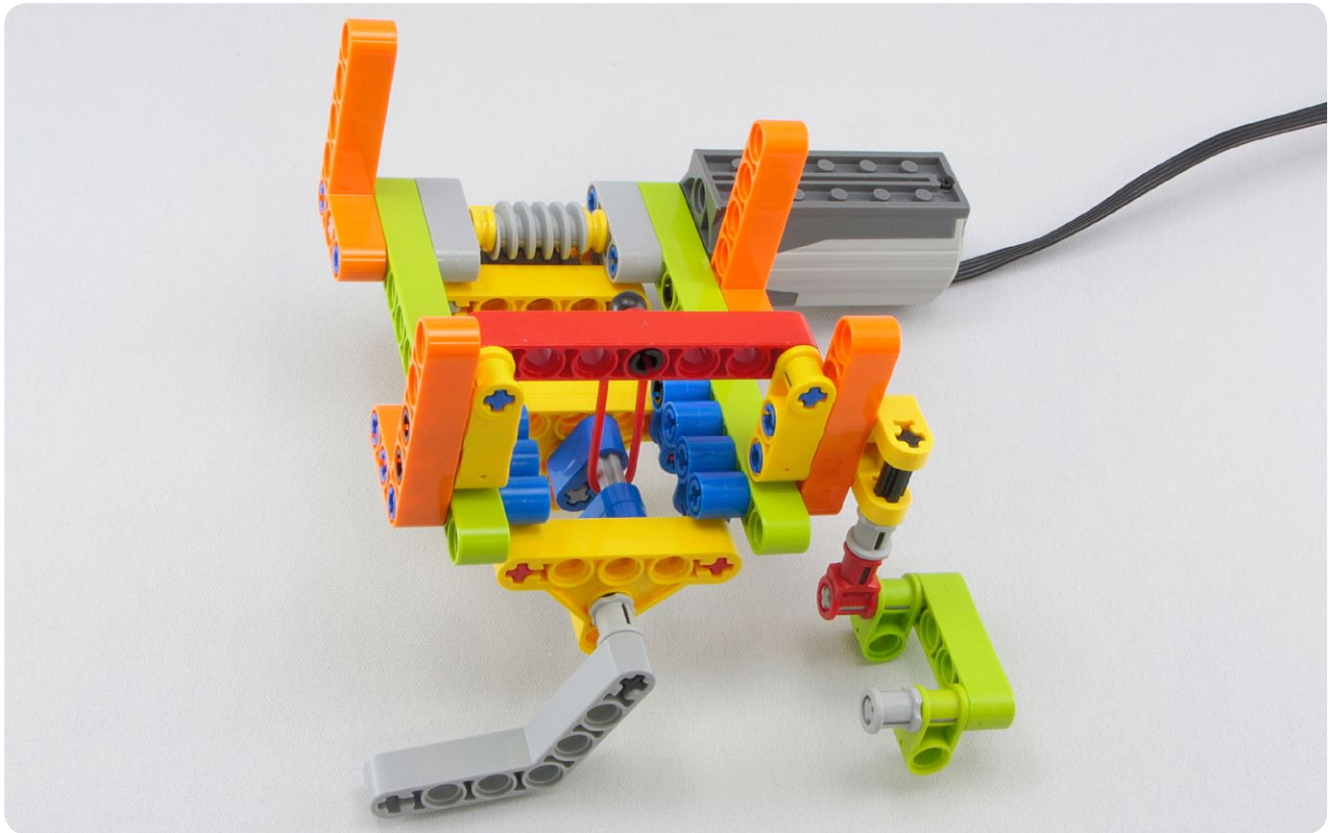
[illegible]

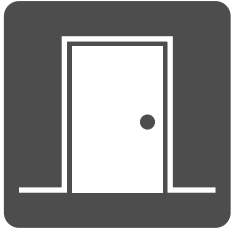


[illegible]



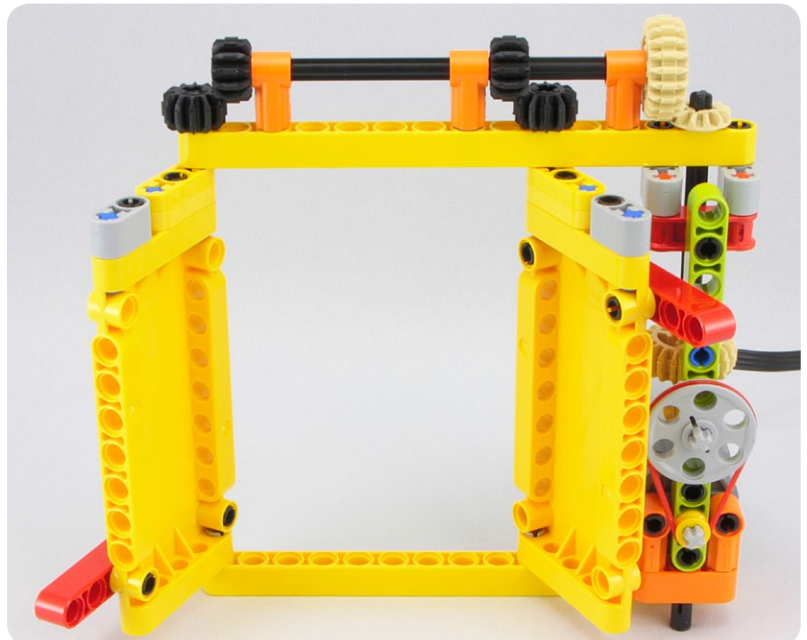
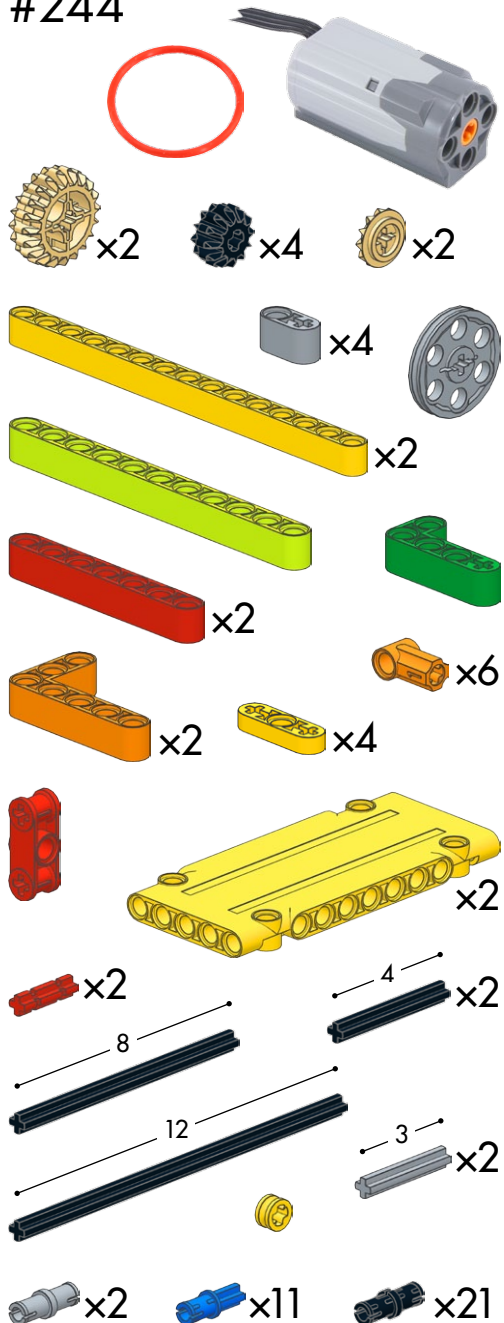


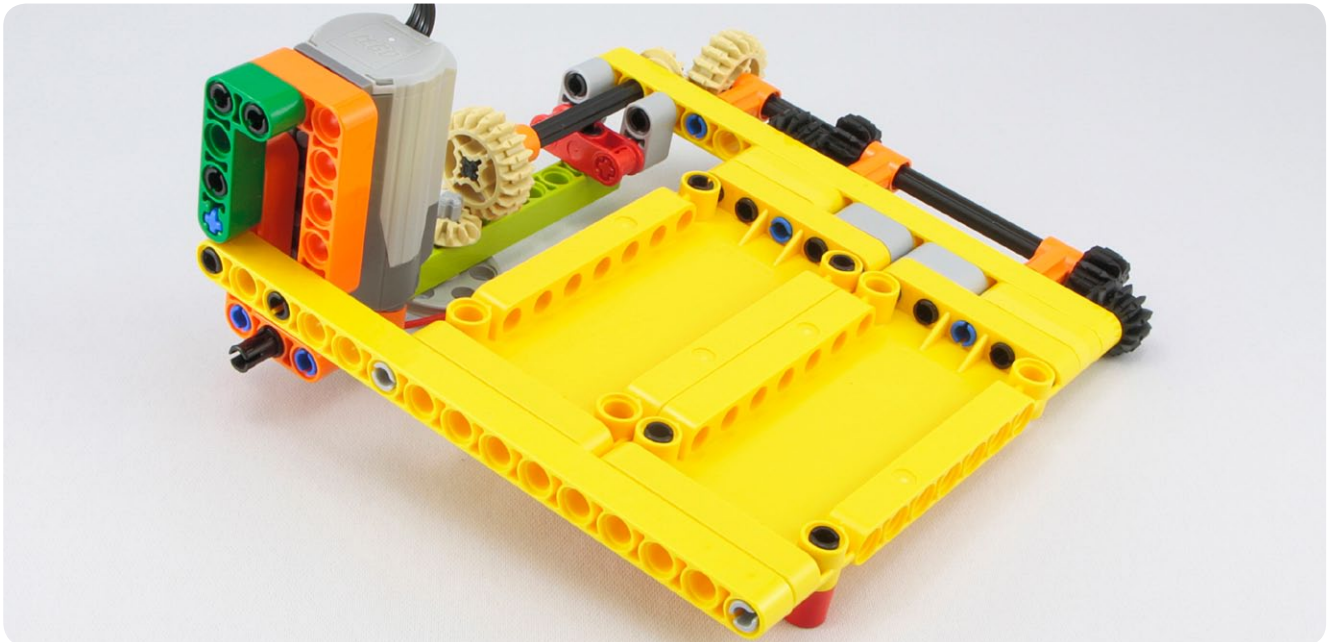
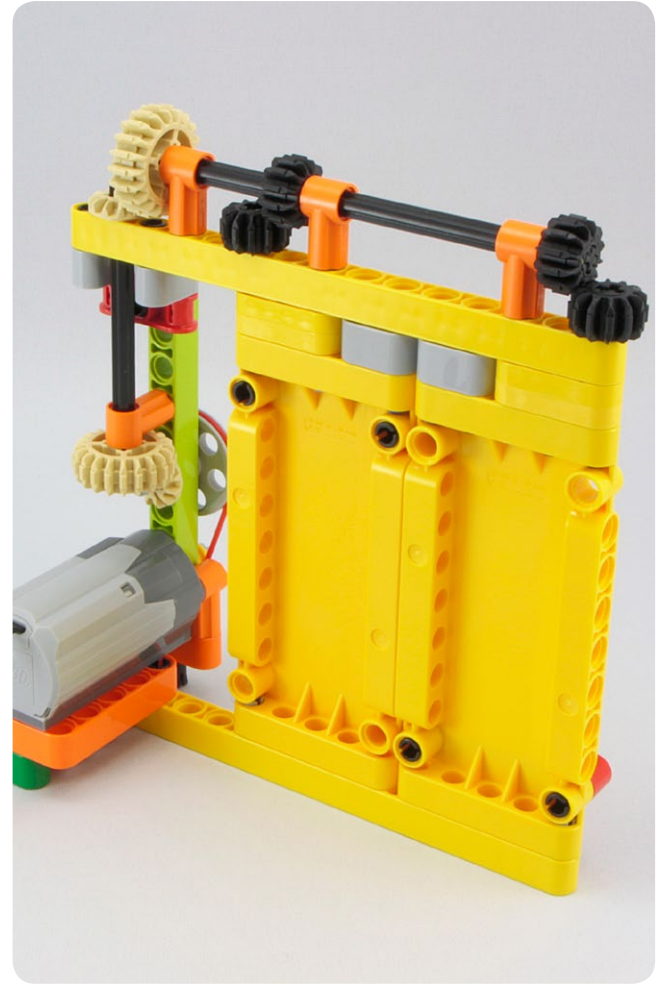




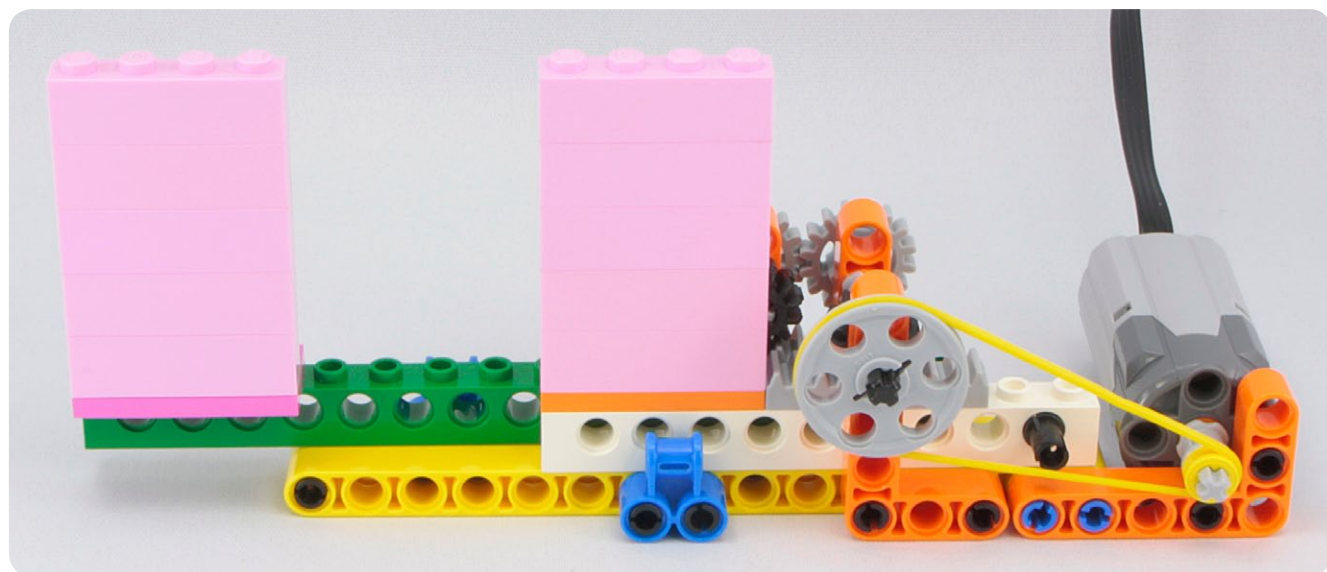
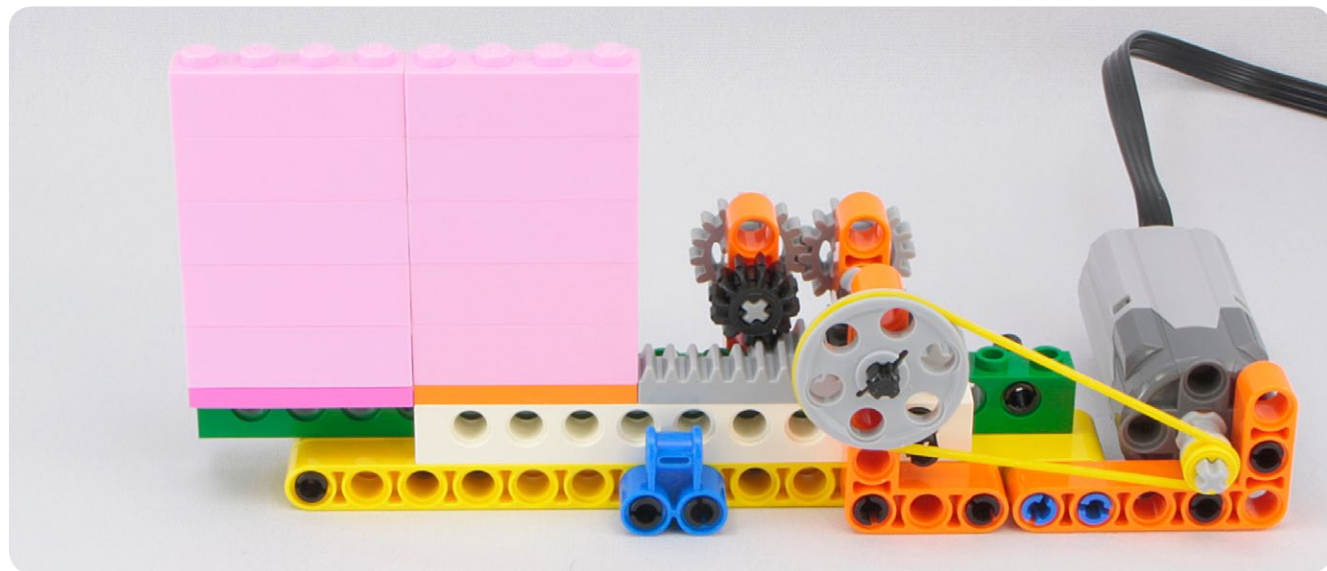
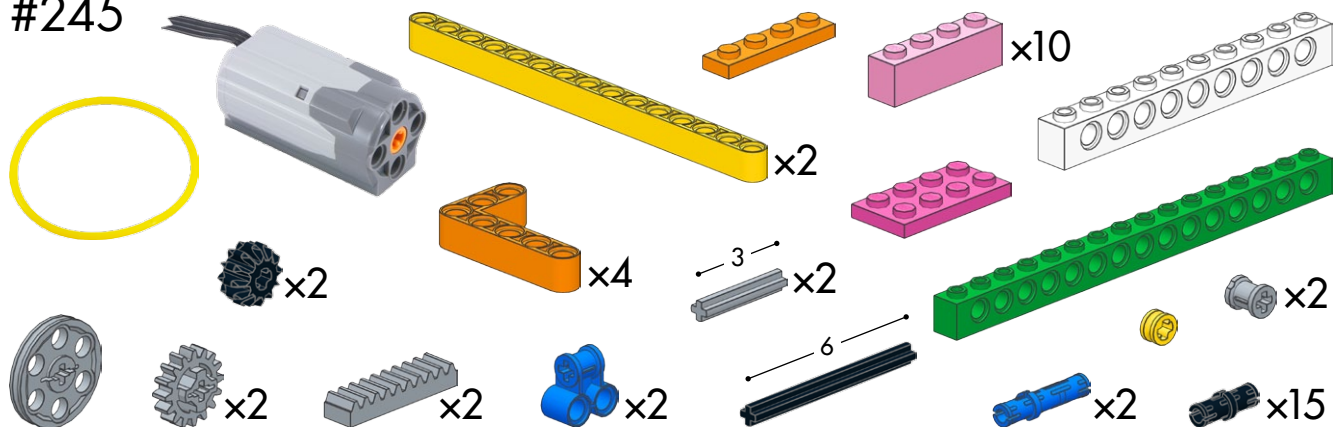
Automatic doors

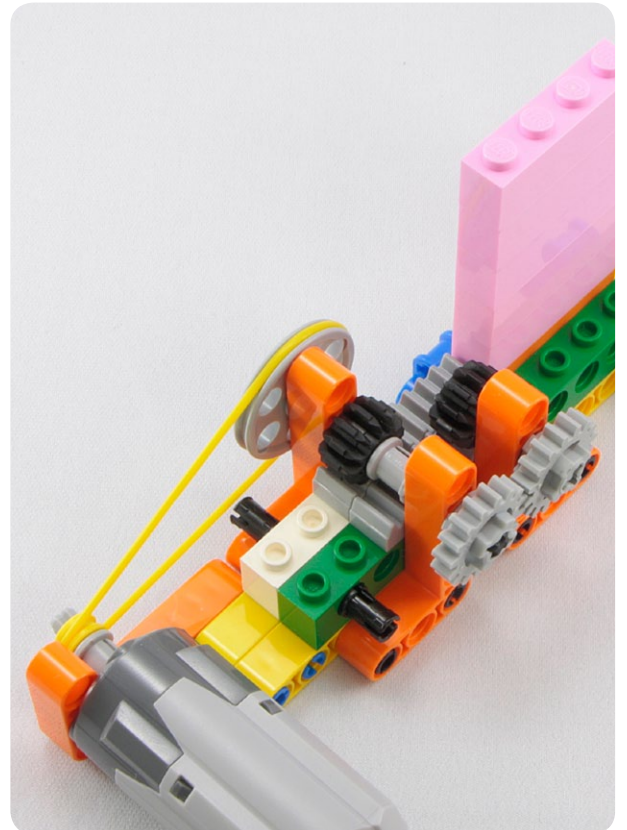
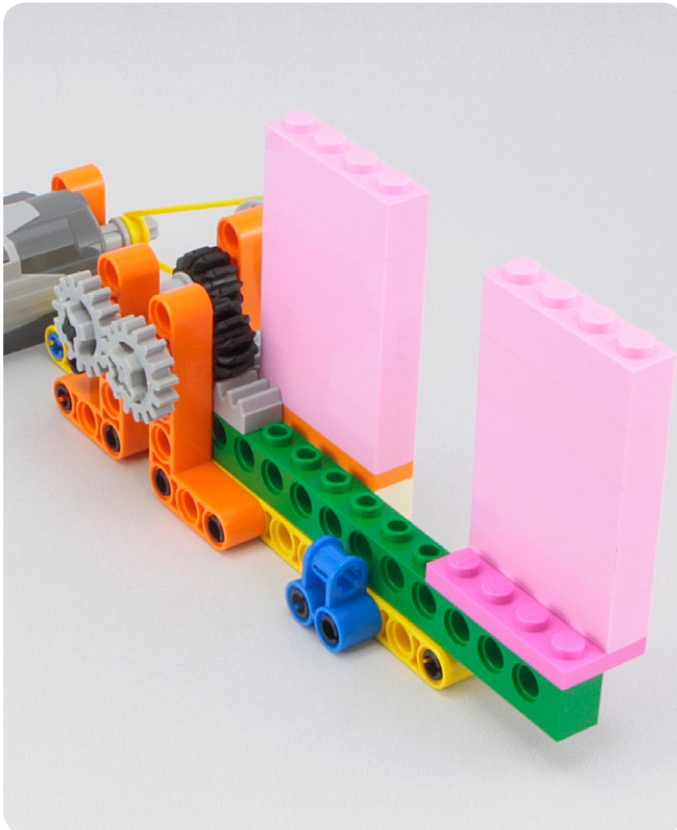
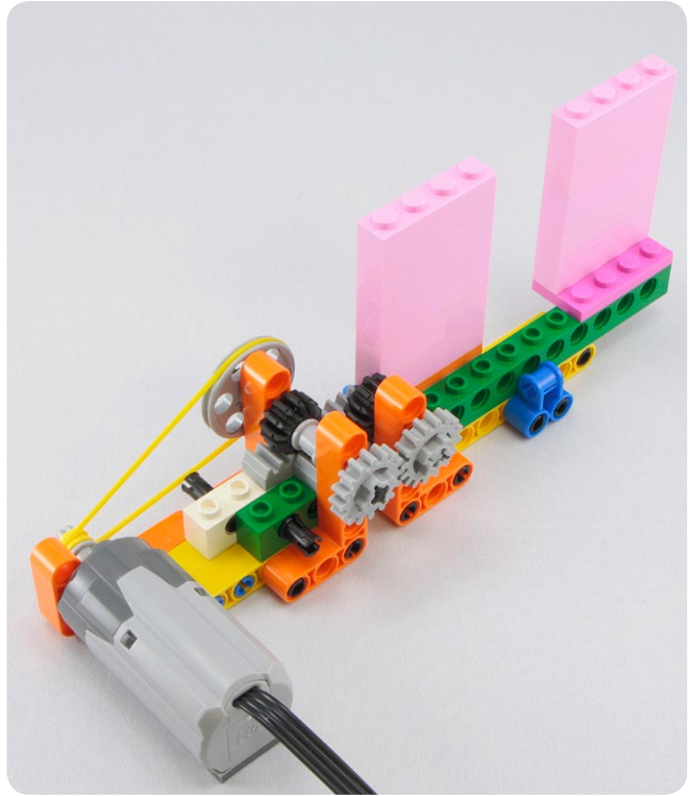
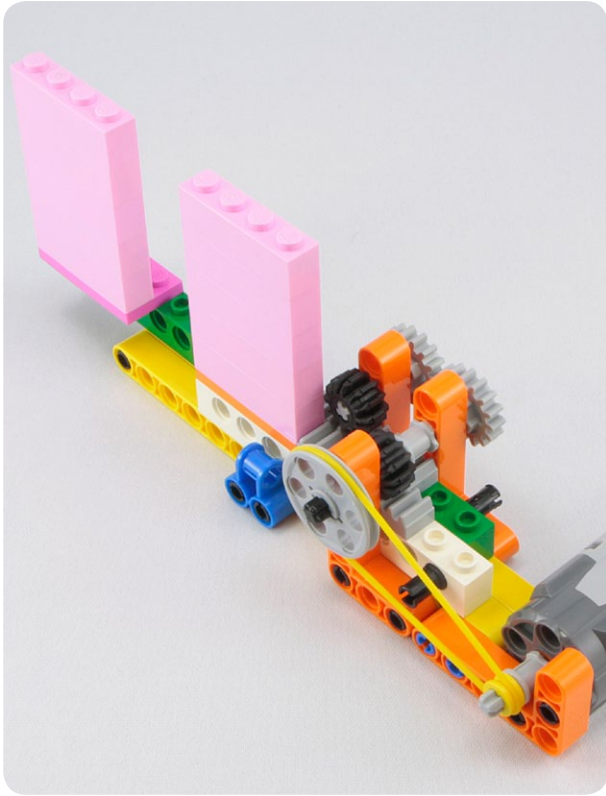
#244



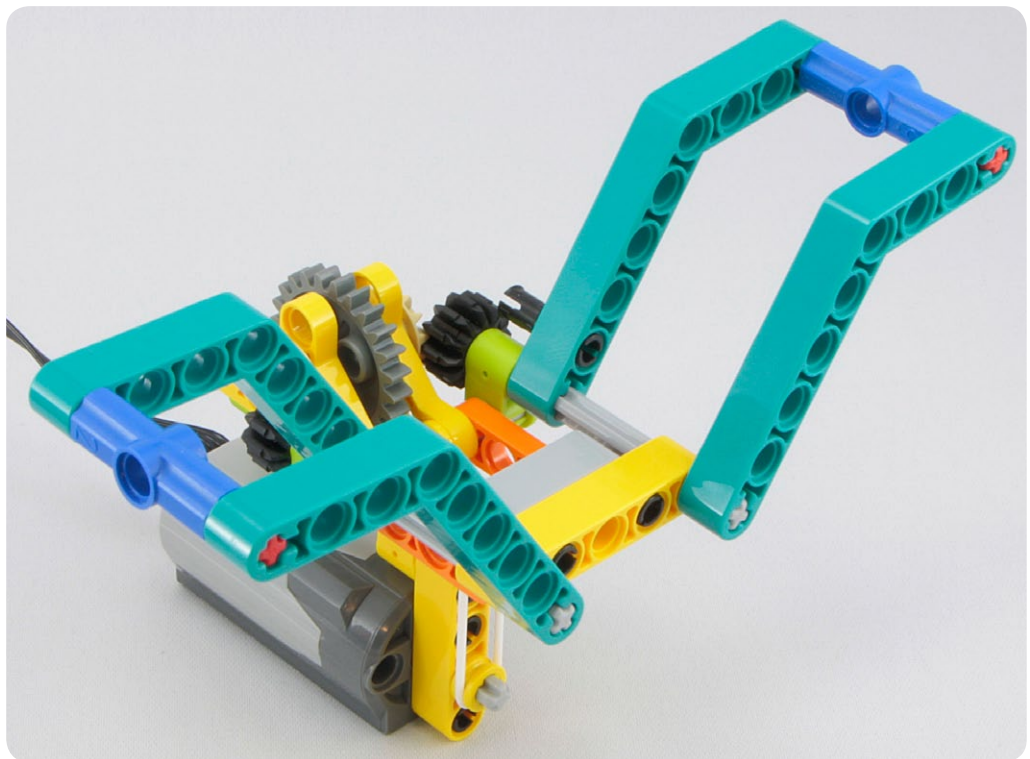
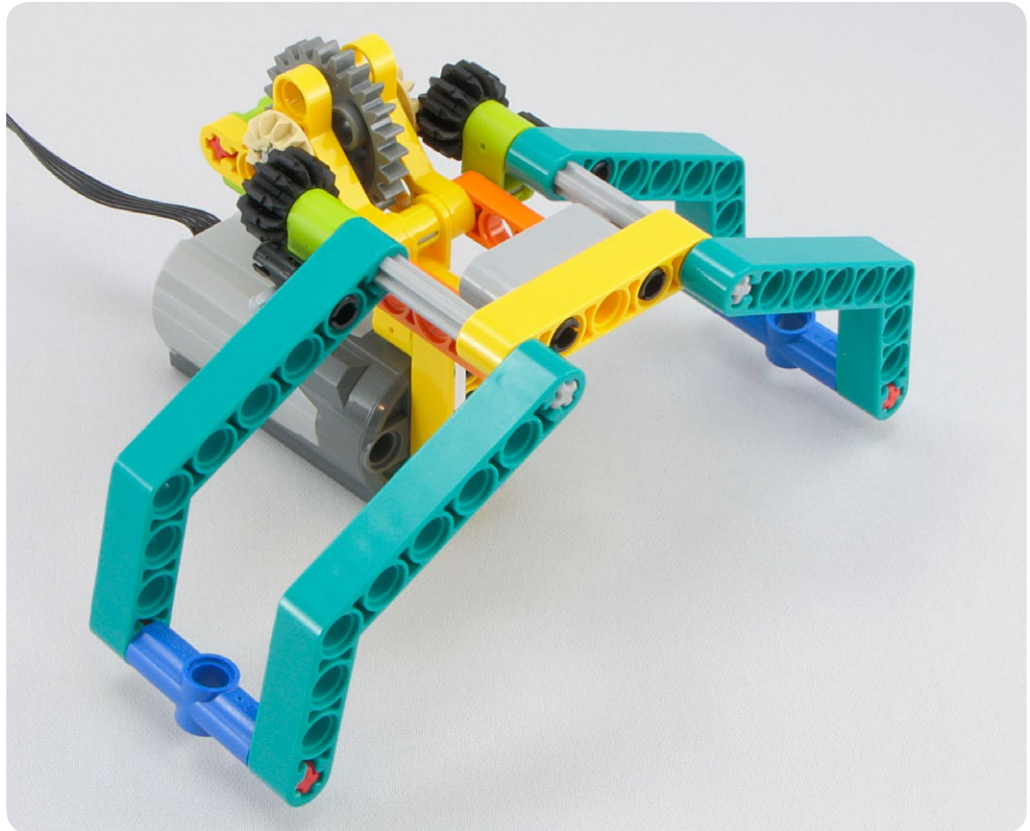
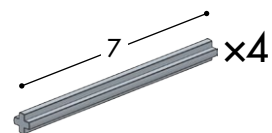
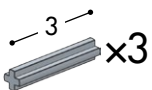
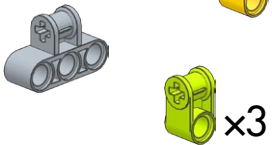
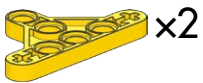
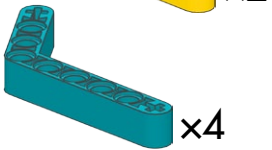
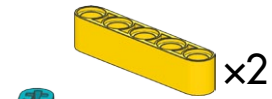


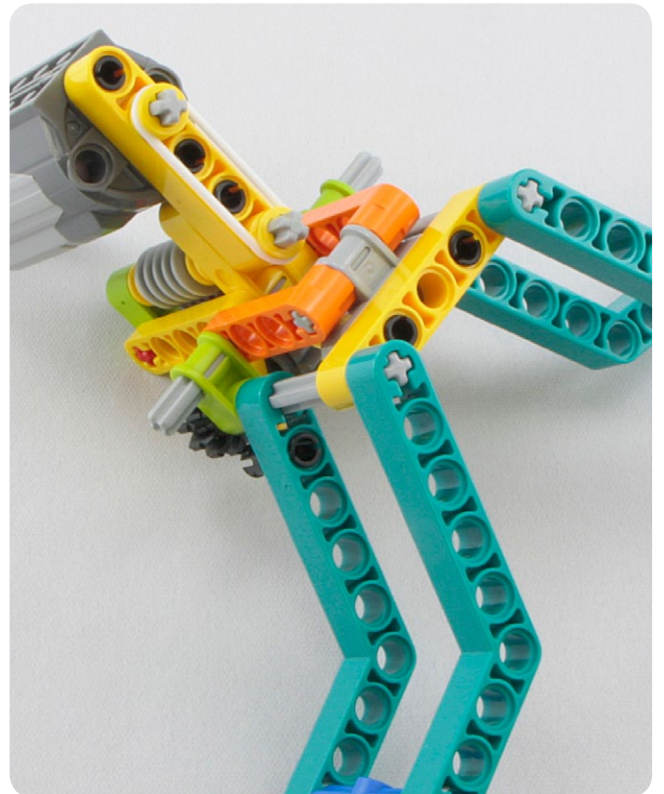
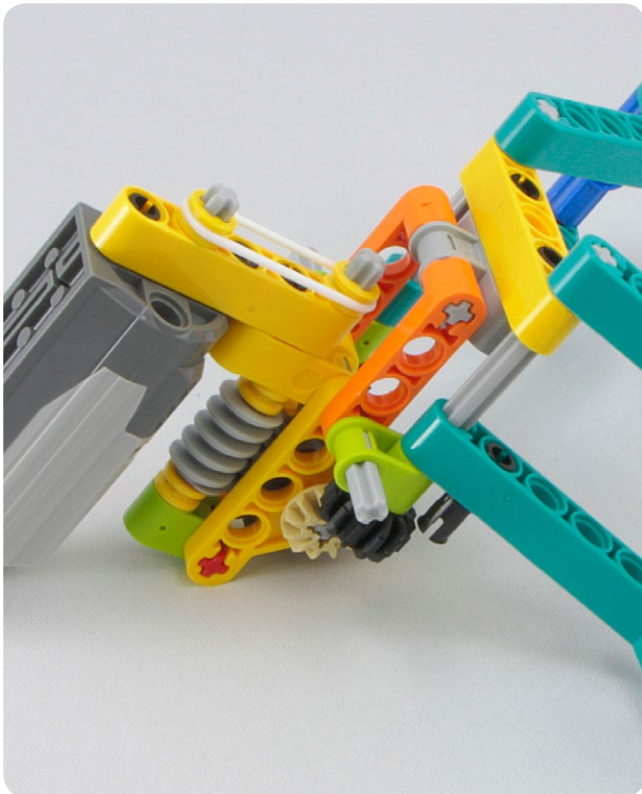
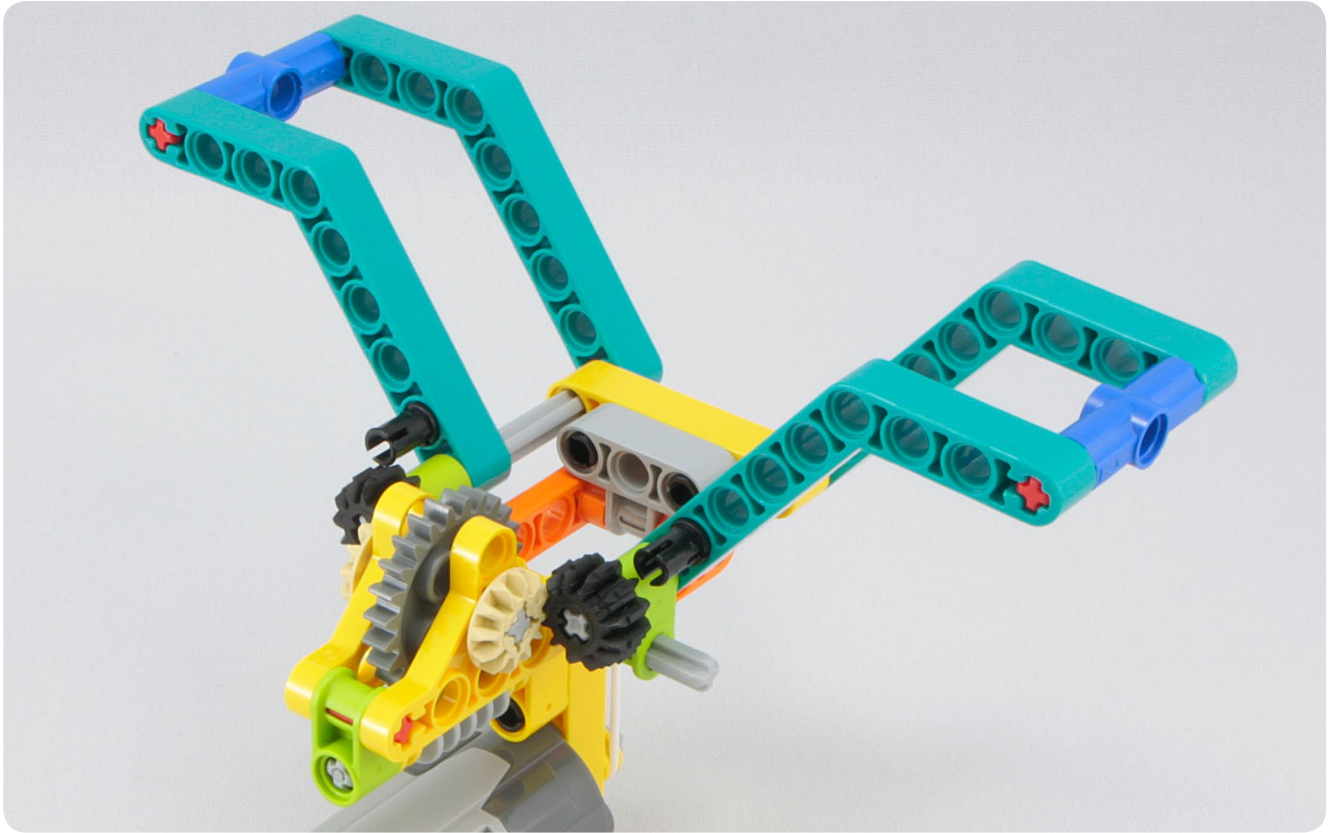
#245





#246

A white O-ring and a grey gear-like component. The O-ring is a simple circular seal. The gear-like component has a central hub with four circular openings and an outer ring with gear teeth.

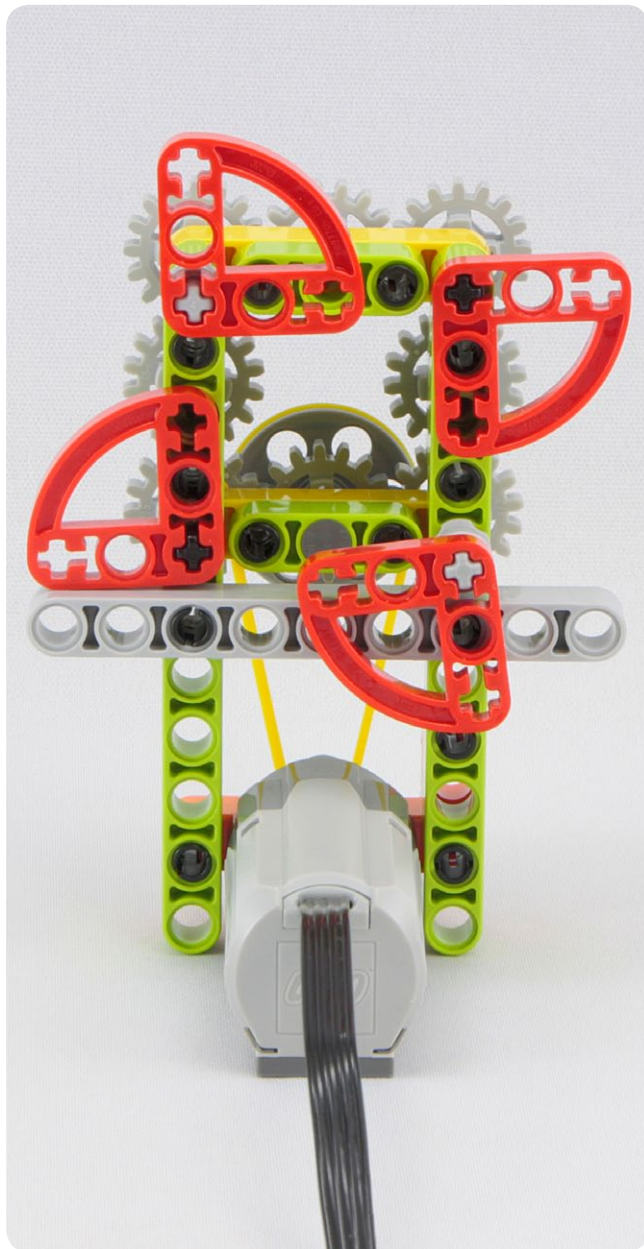
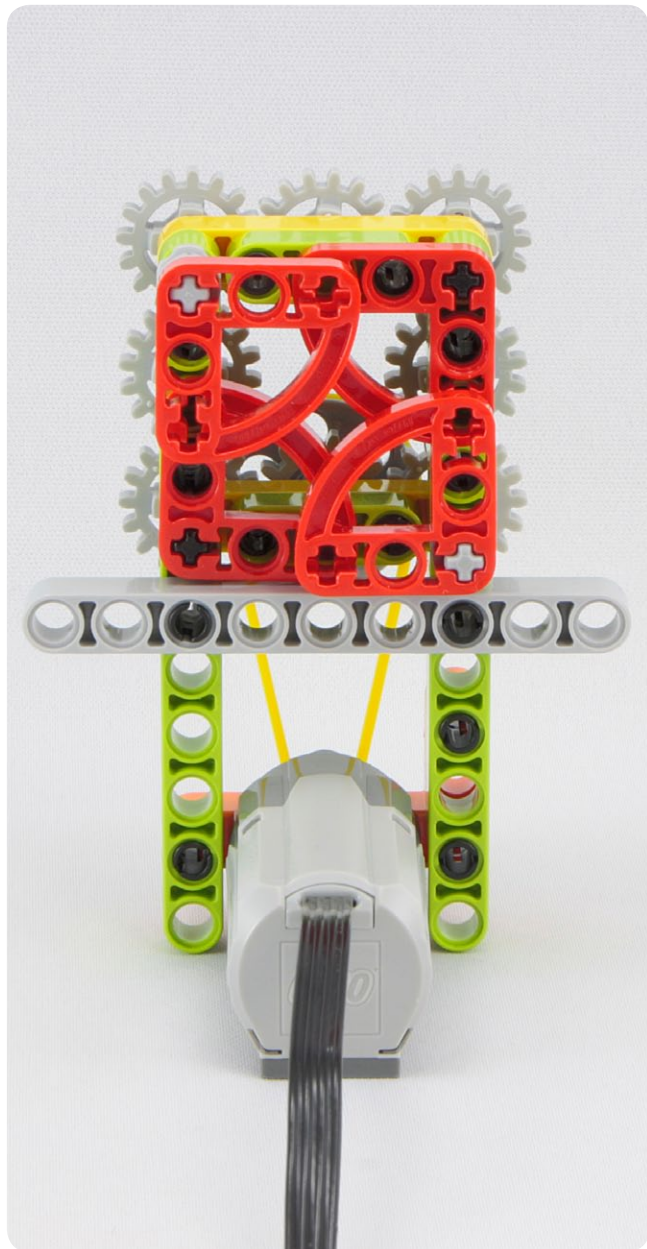


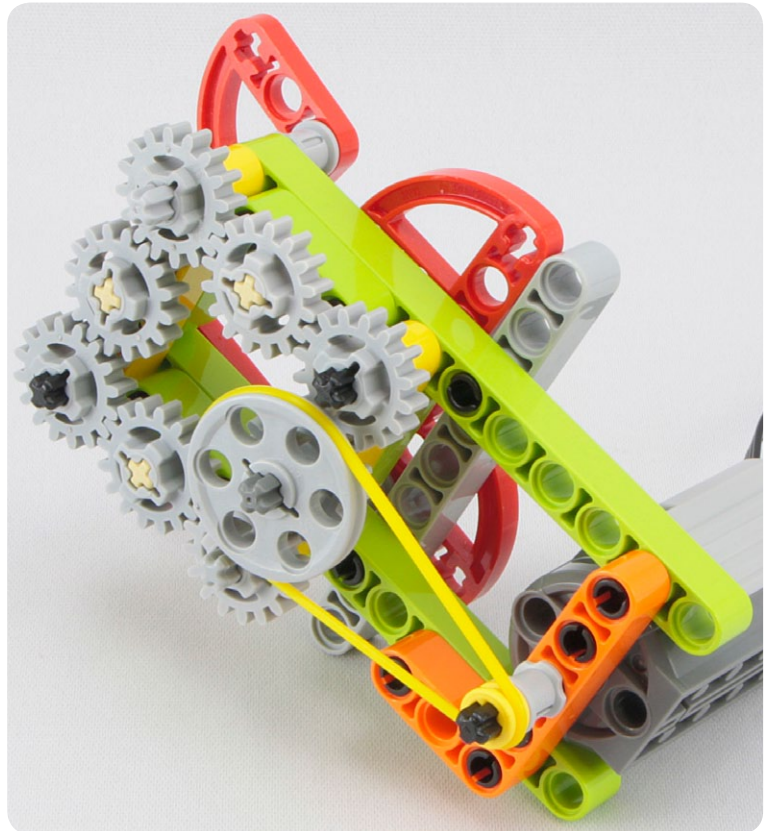
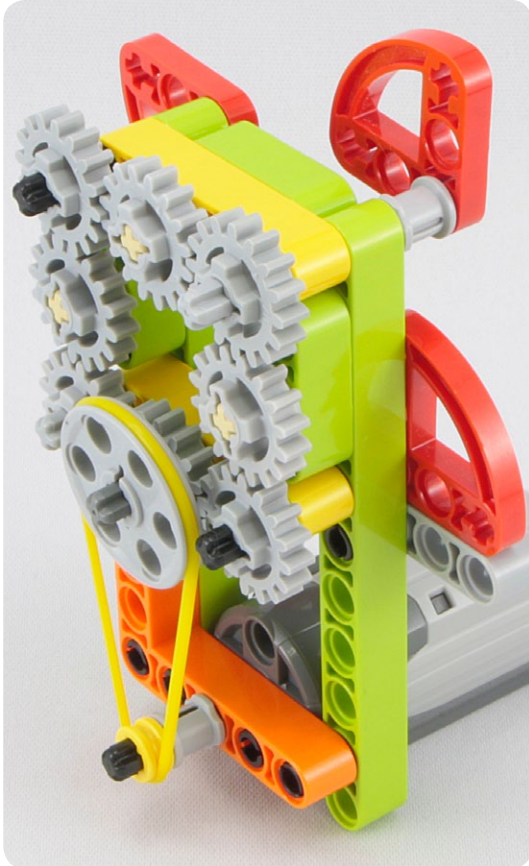
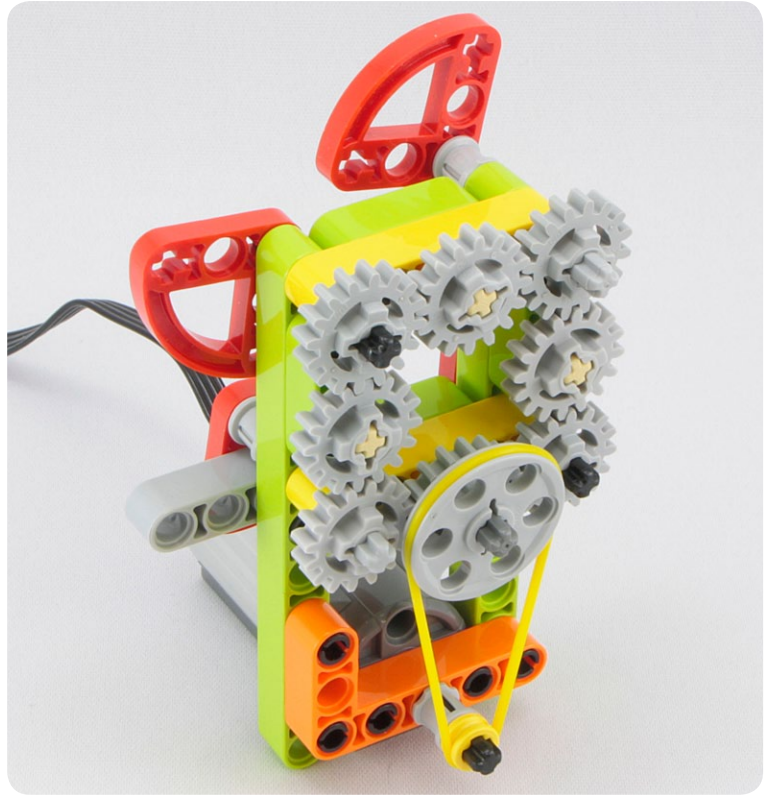
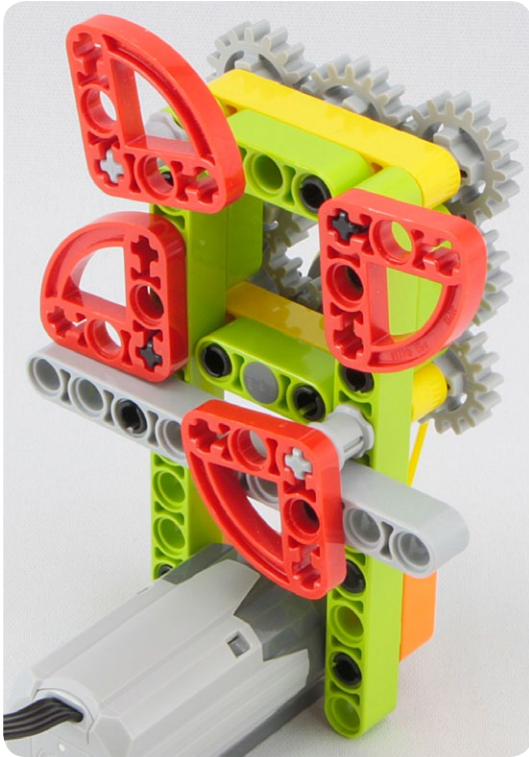
#24/



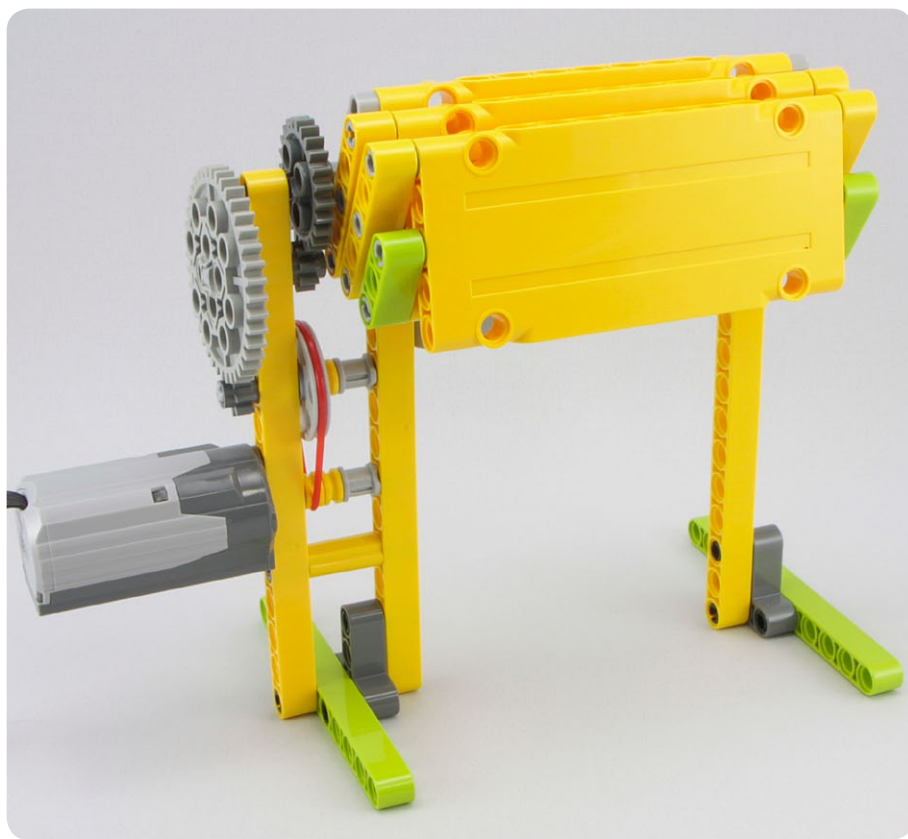
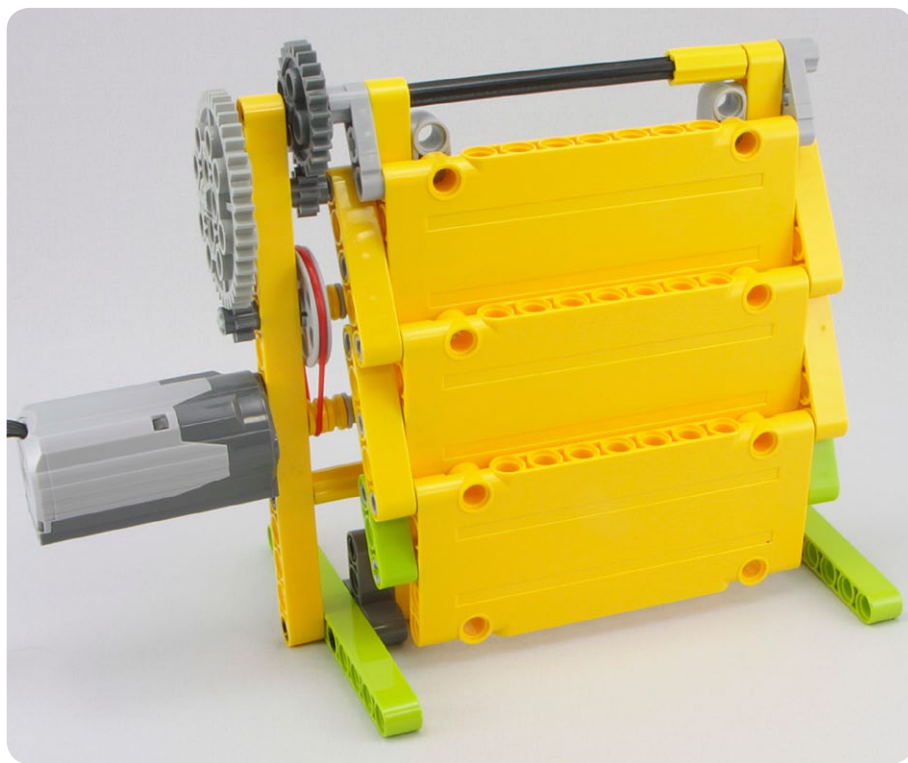
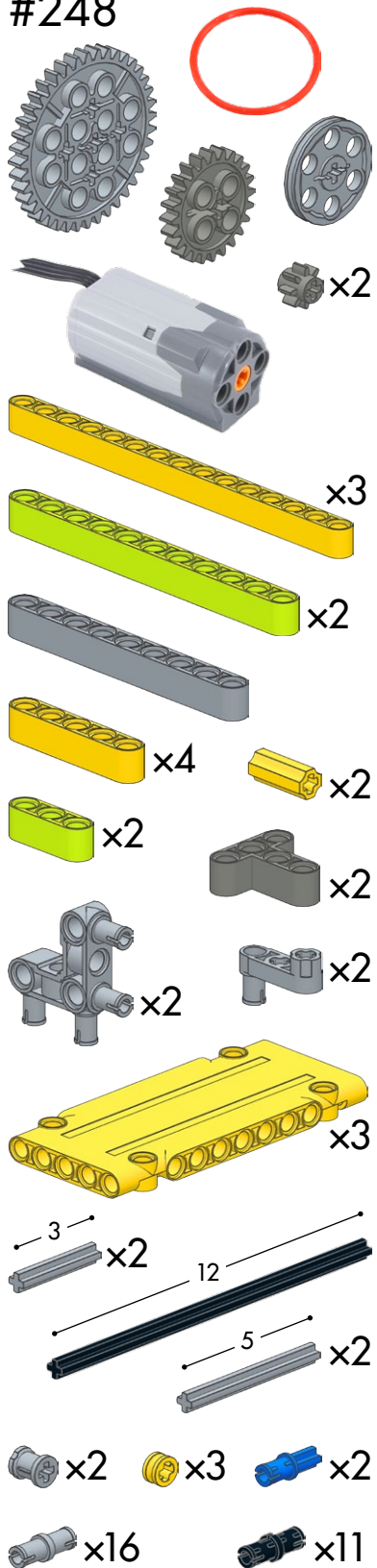
LEGO parts list for step 24:

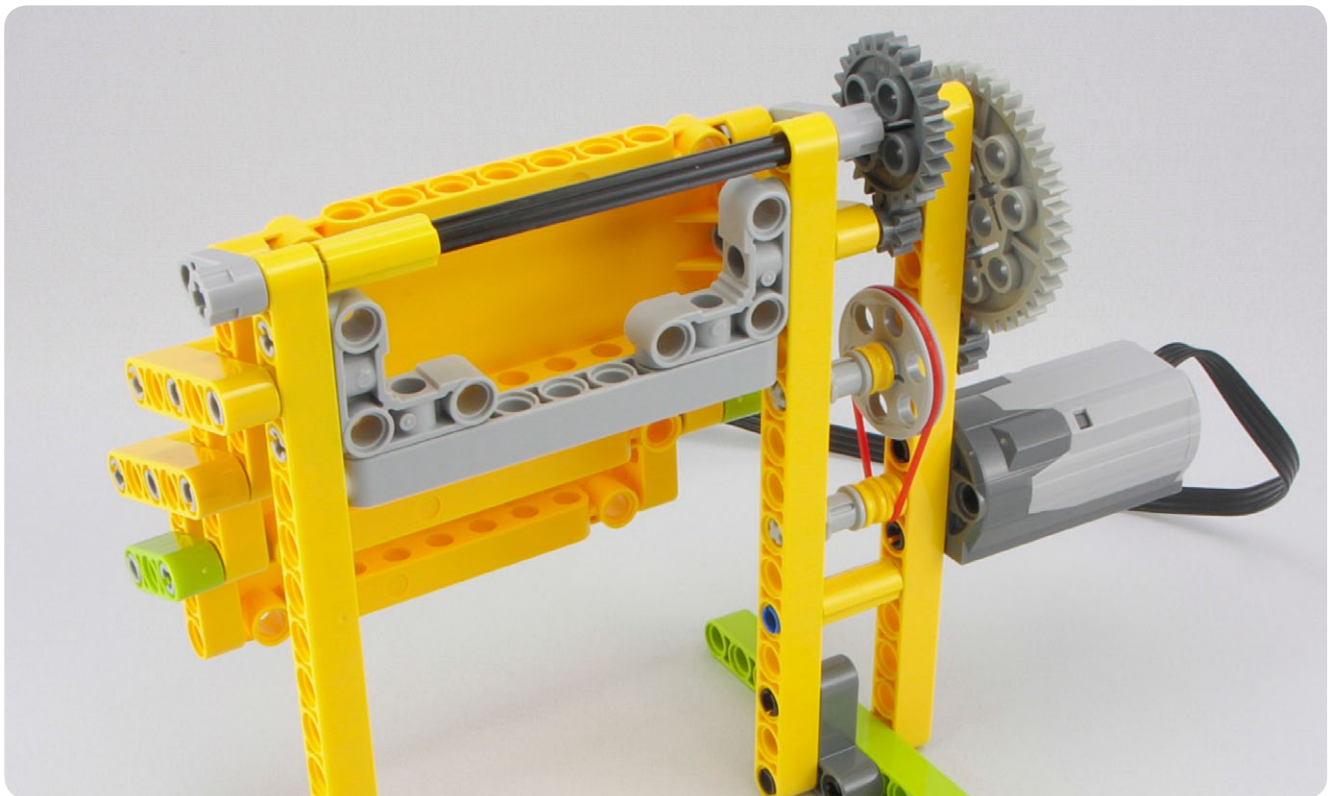
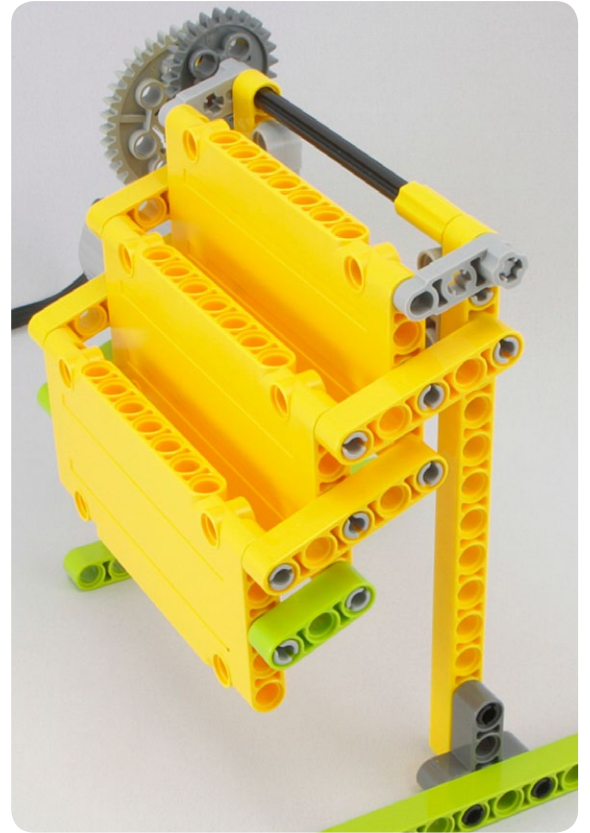
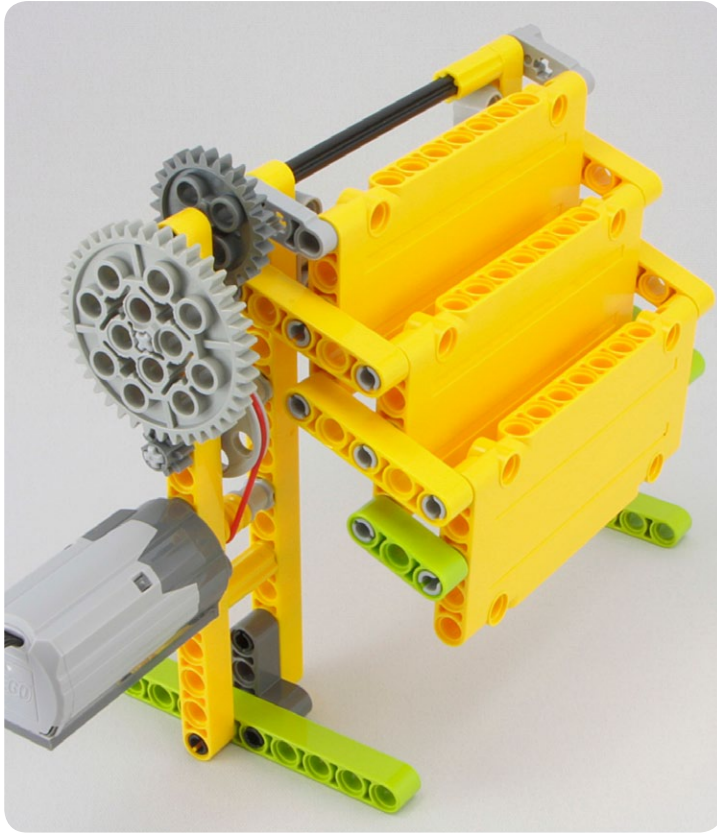
- 1 yellow ring
- 1 grey motor
- 1 grey gear
- 1 grey wheel
- 2 light green 1x6 Technic beams
- 1 grey 1x6 Technic beam
- 2 yellow 1x6 Technic beams
- 4 light green 1x3 Technic beams
- 2 red 1x3 Technic beams
- 3 orange 1x3 Technic beams
- 3 black 4-hole Technic pins
- 3 grey 4-hole Technic pins
- 2 grey 5-hole Technic pins
- 3 yellow axles
- 3 grey axles
- 3 black axles
- 3 grey bush
- 3 tan bush
- 15 black pins



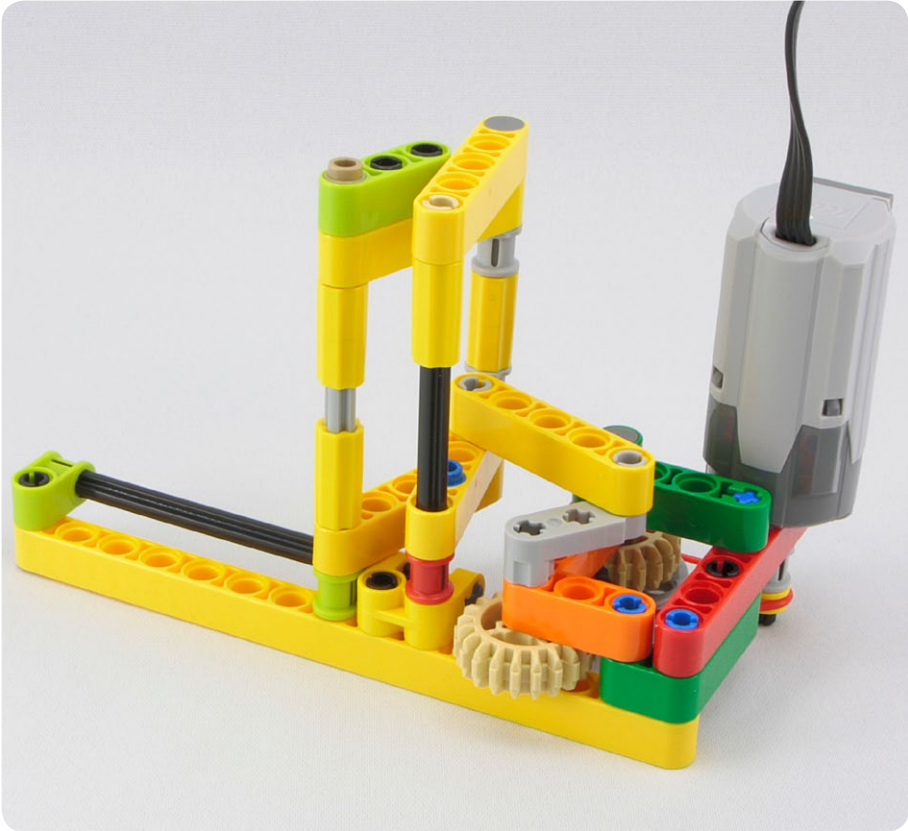
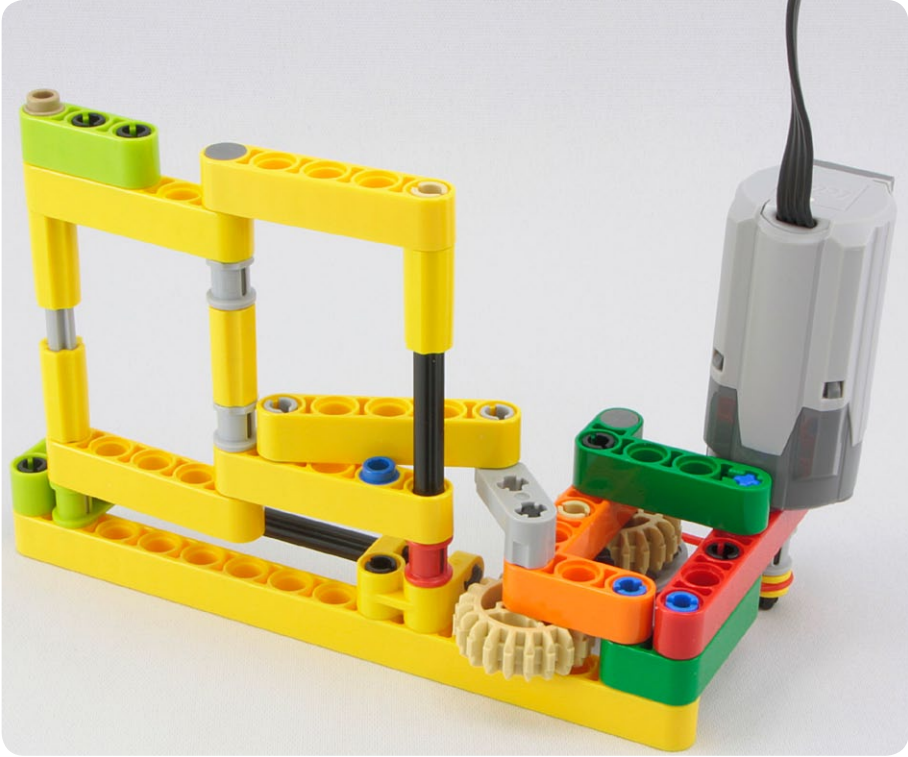
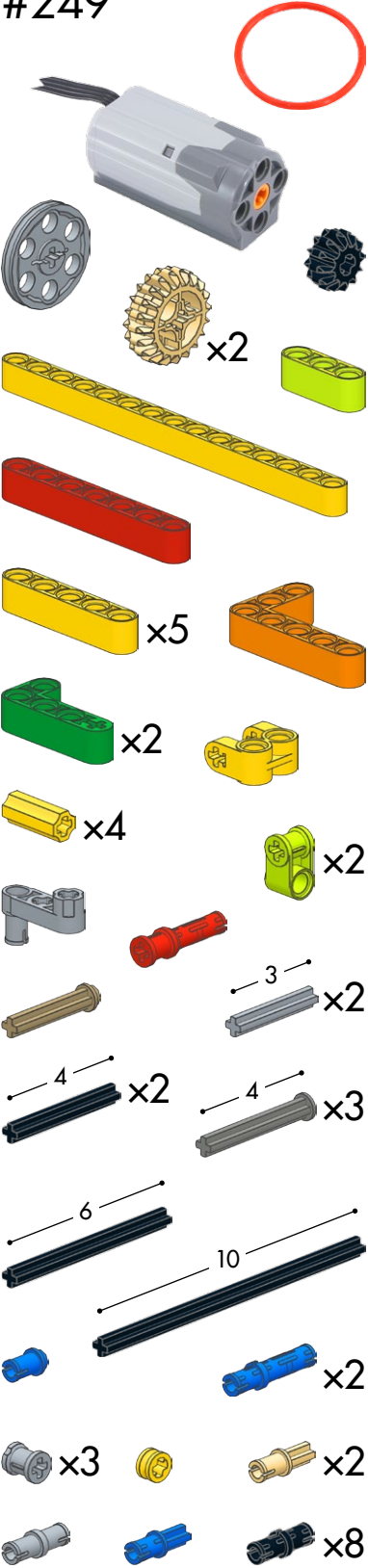


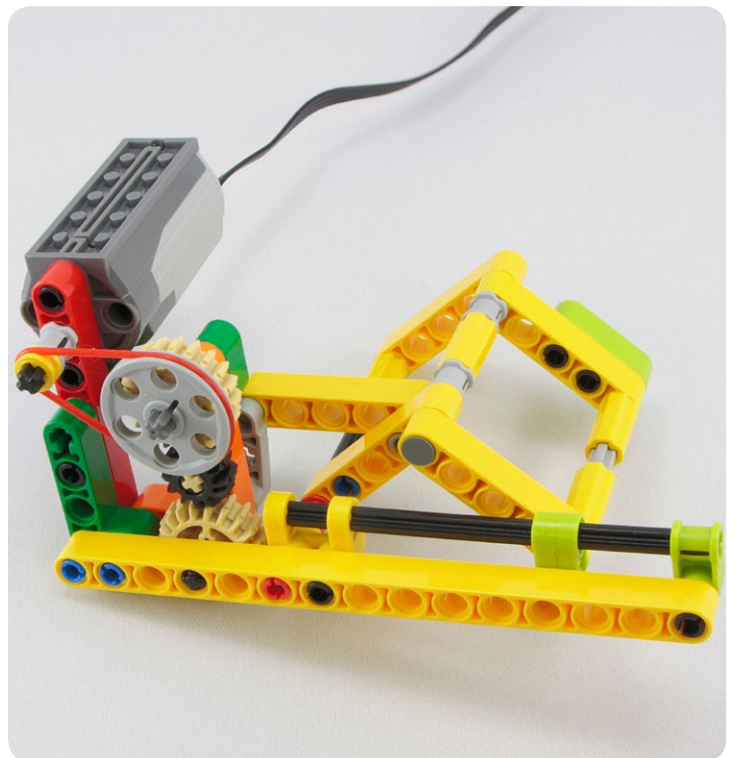
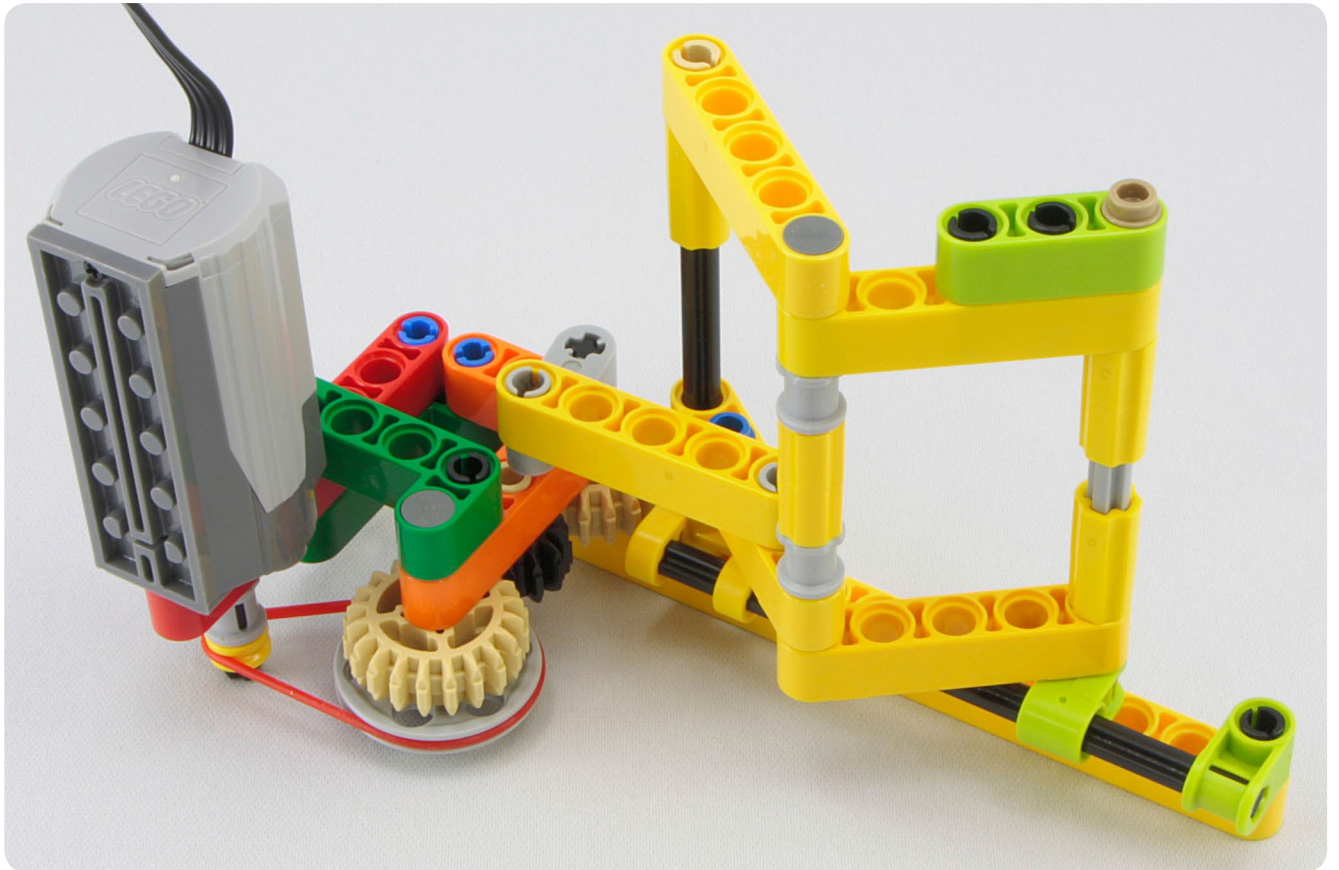
#248

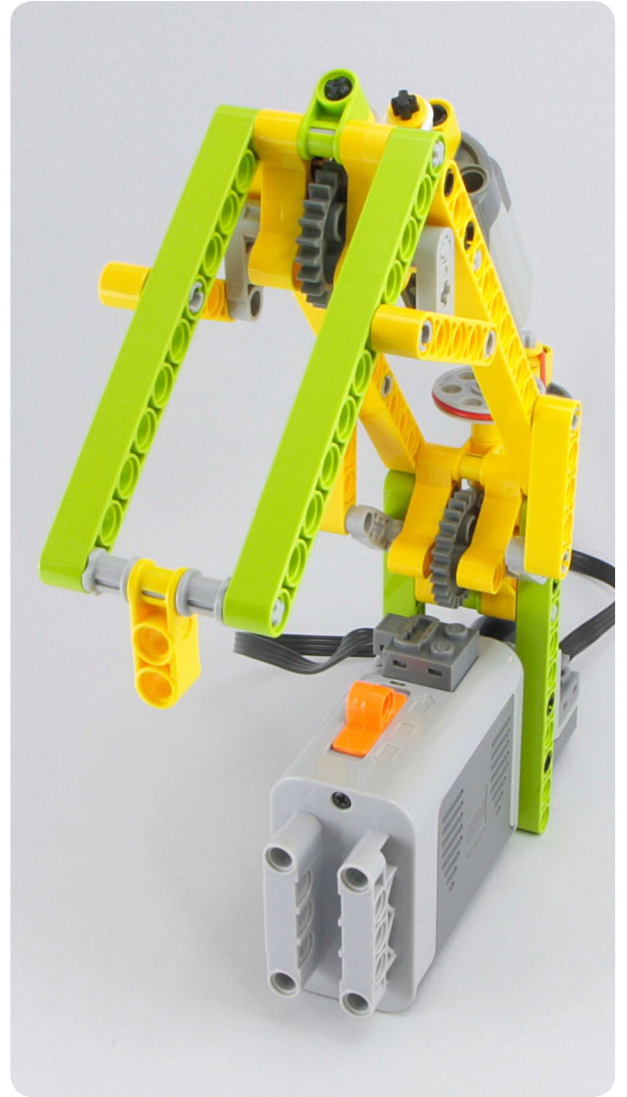


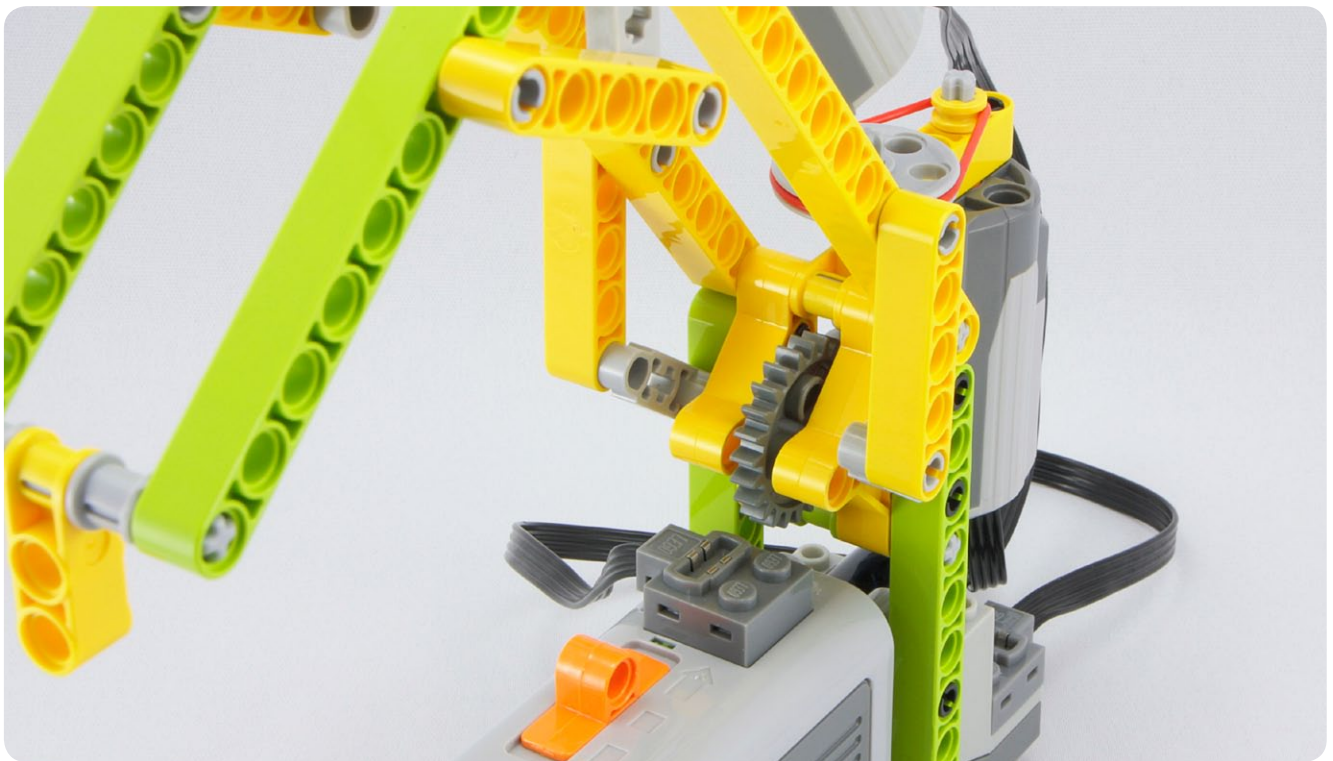
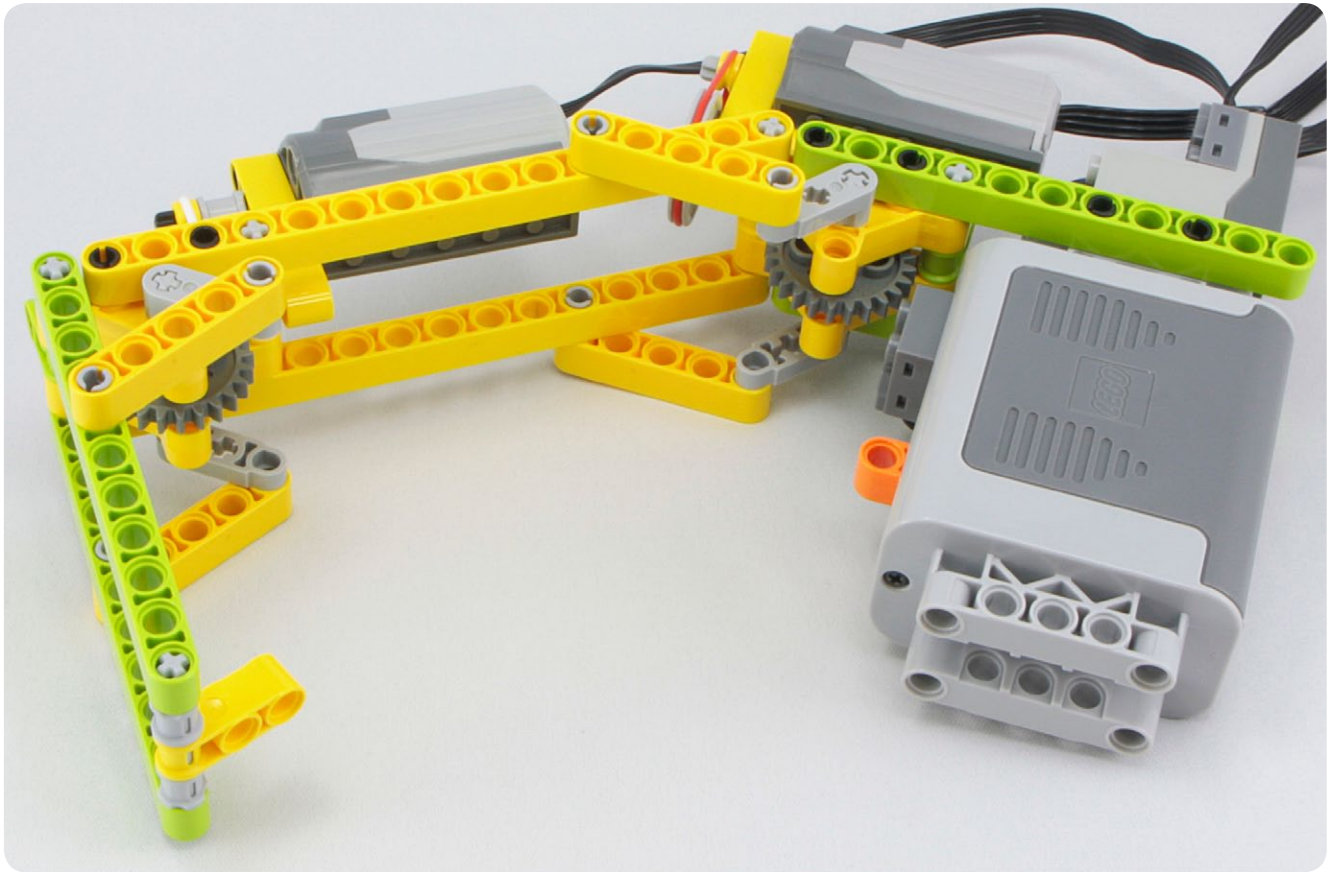


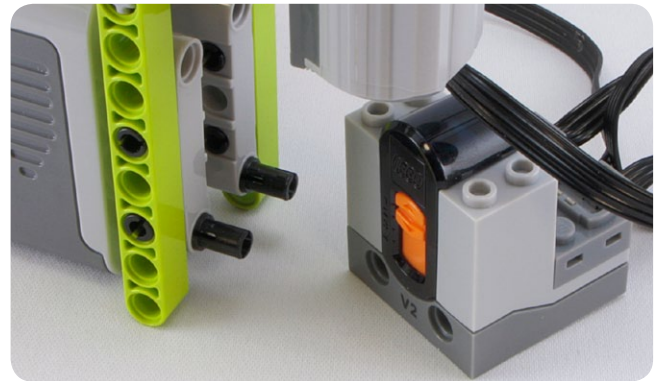
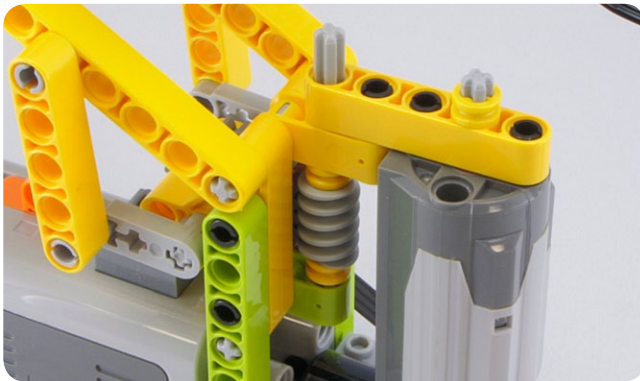
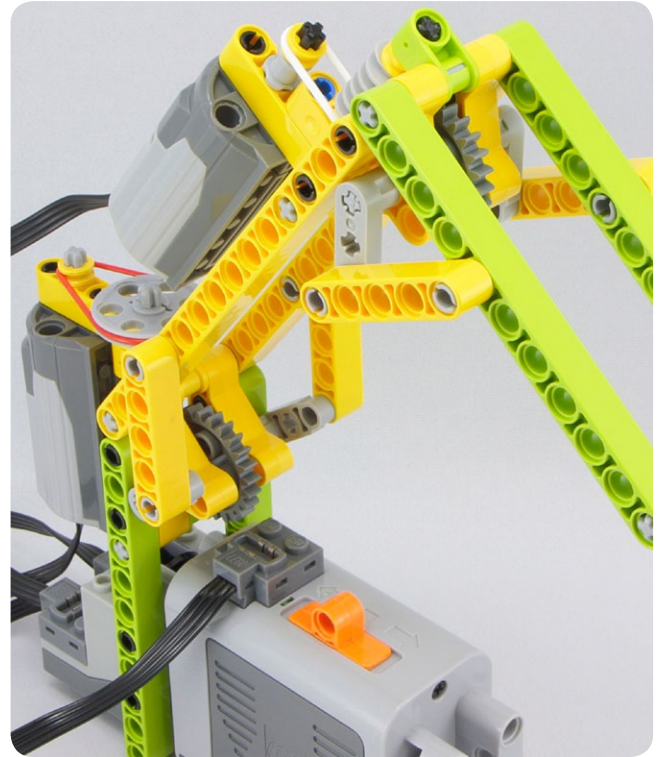
#249

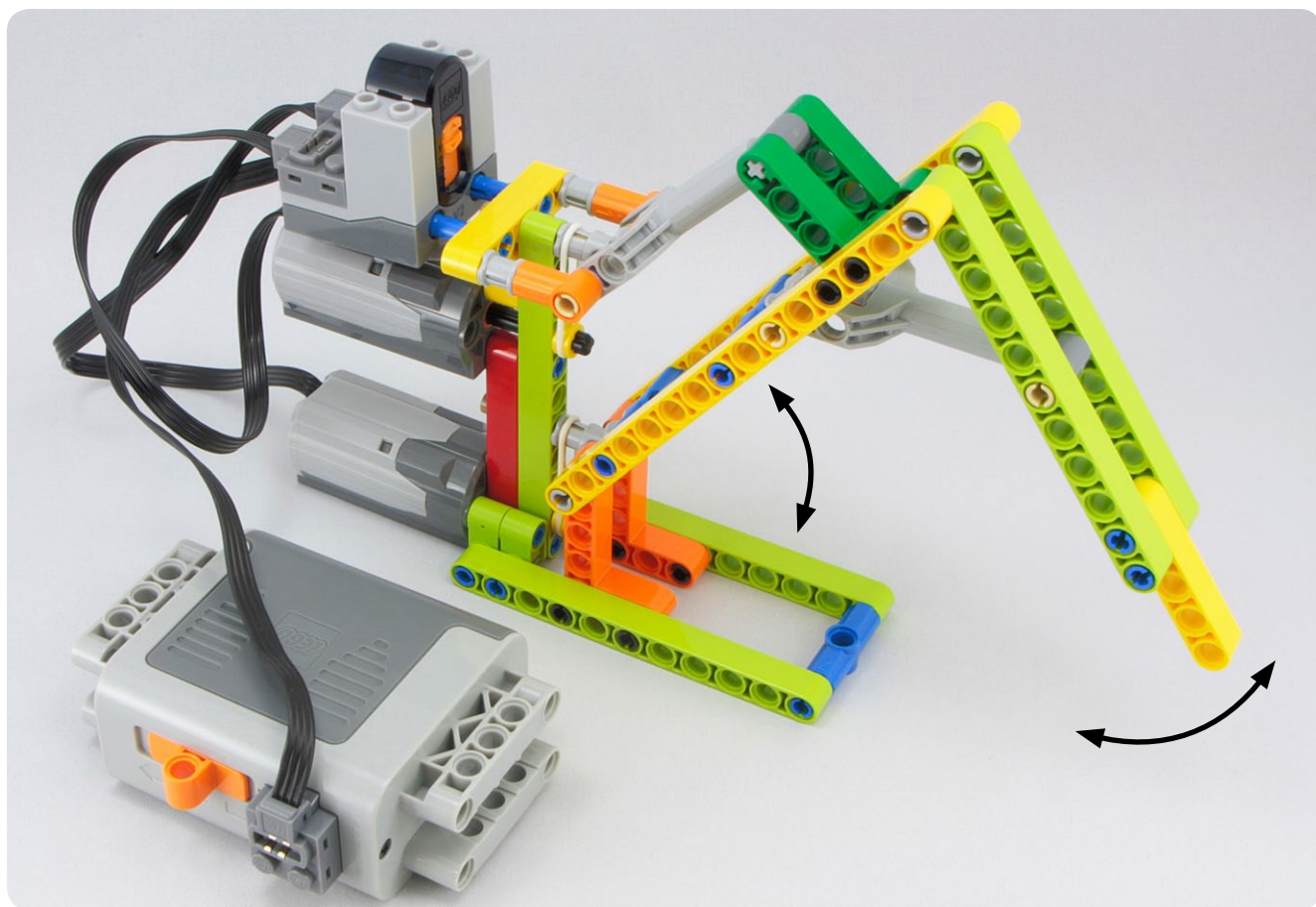


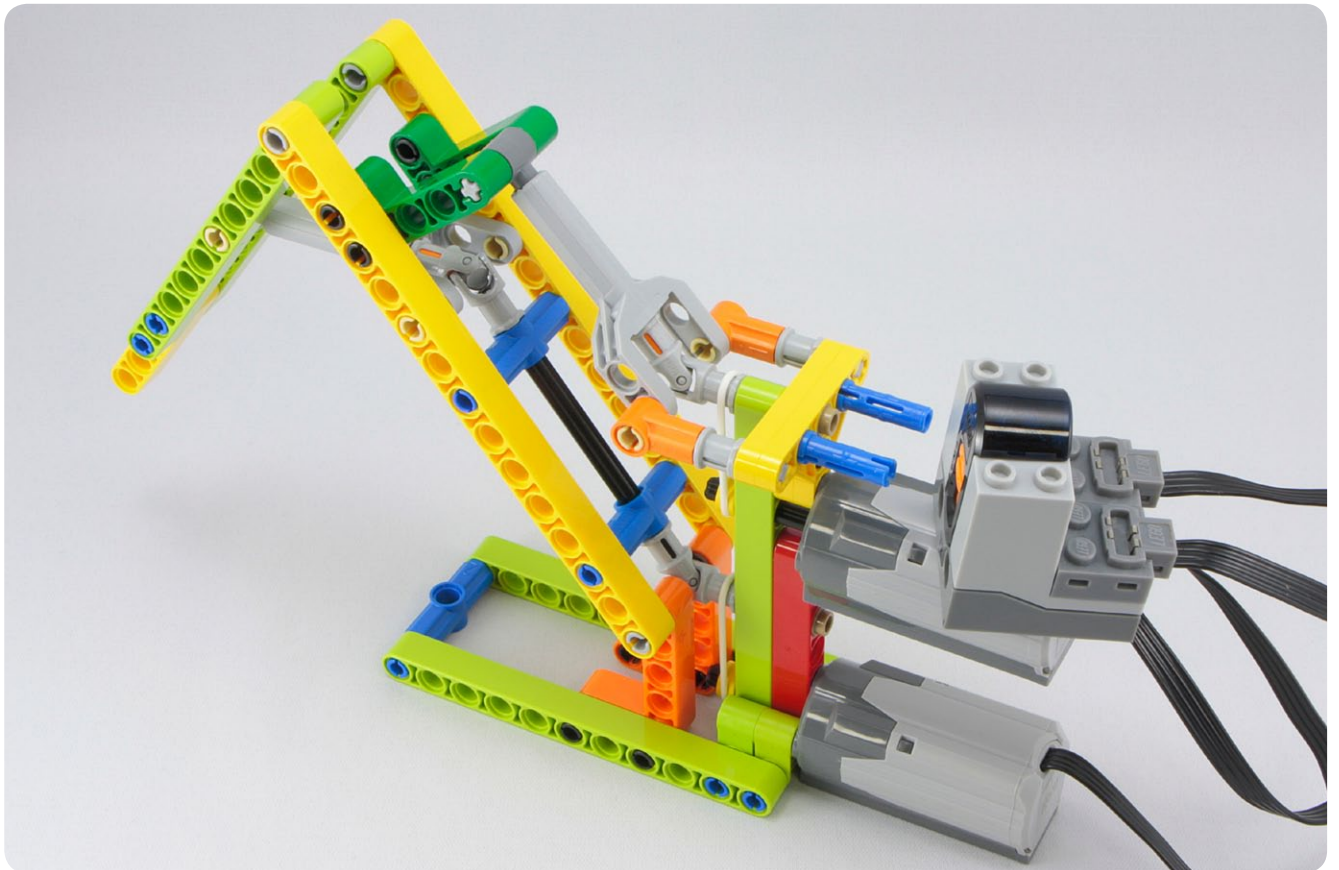
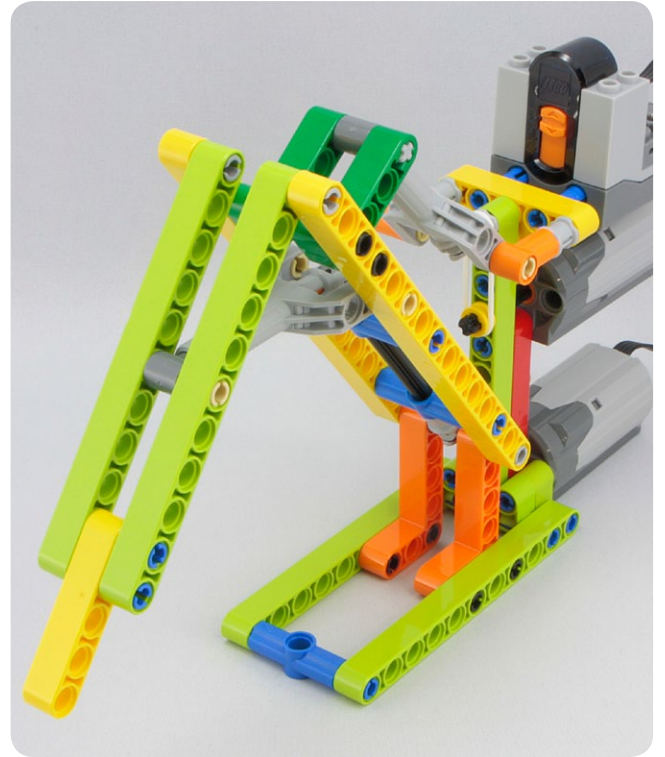
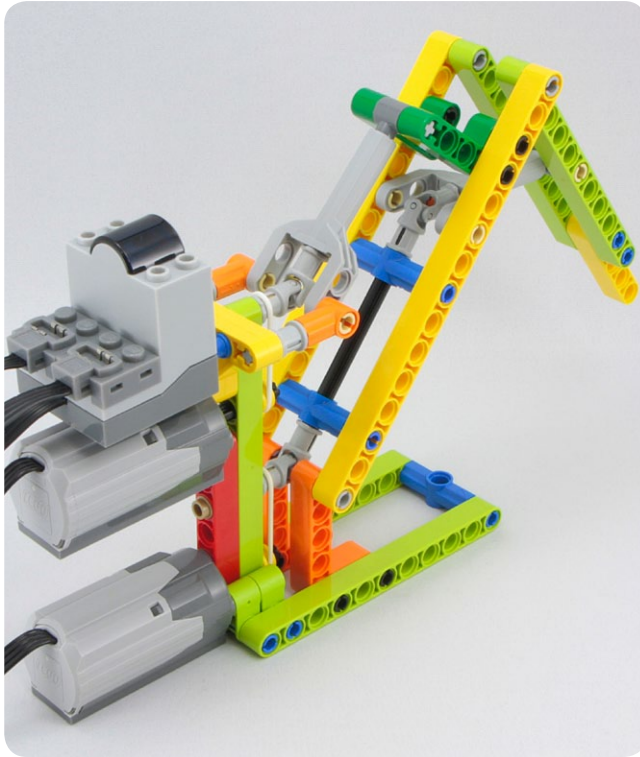


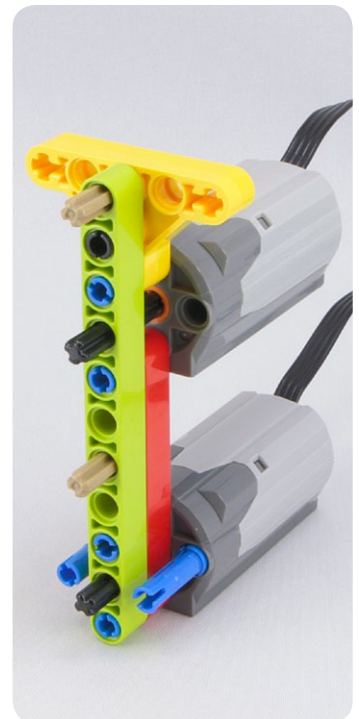
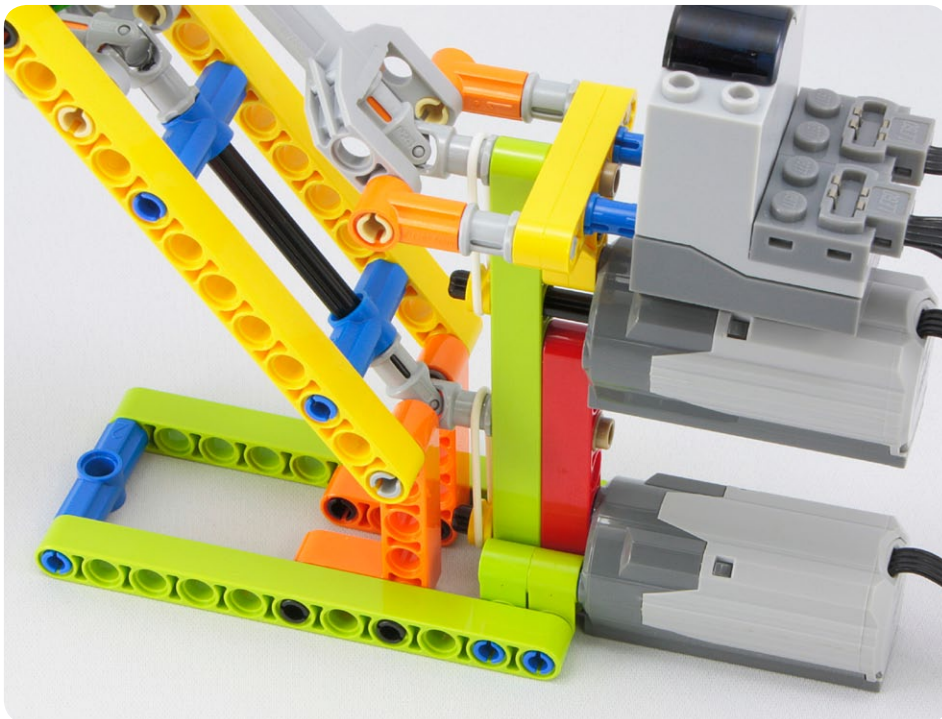
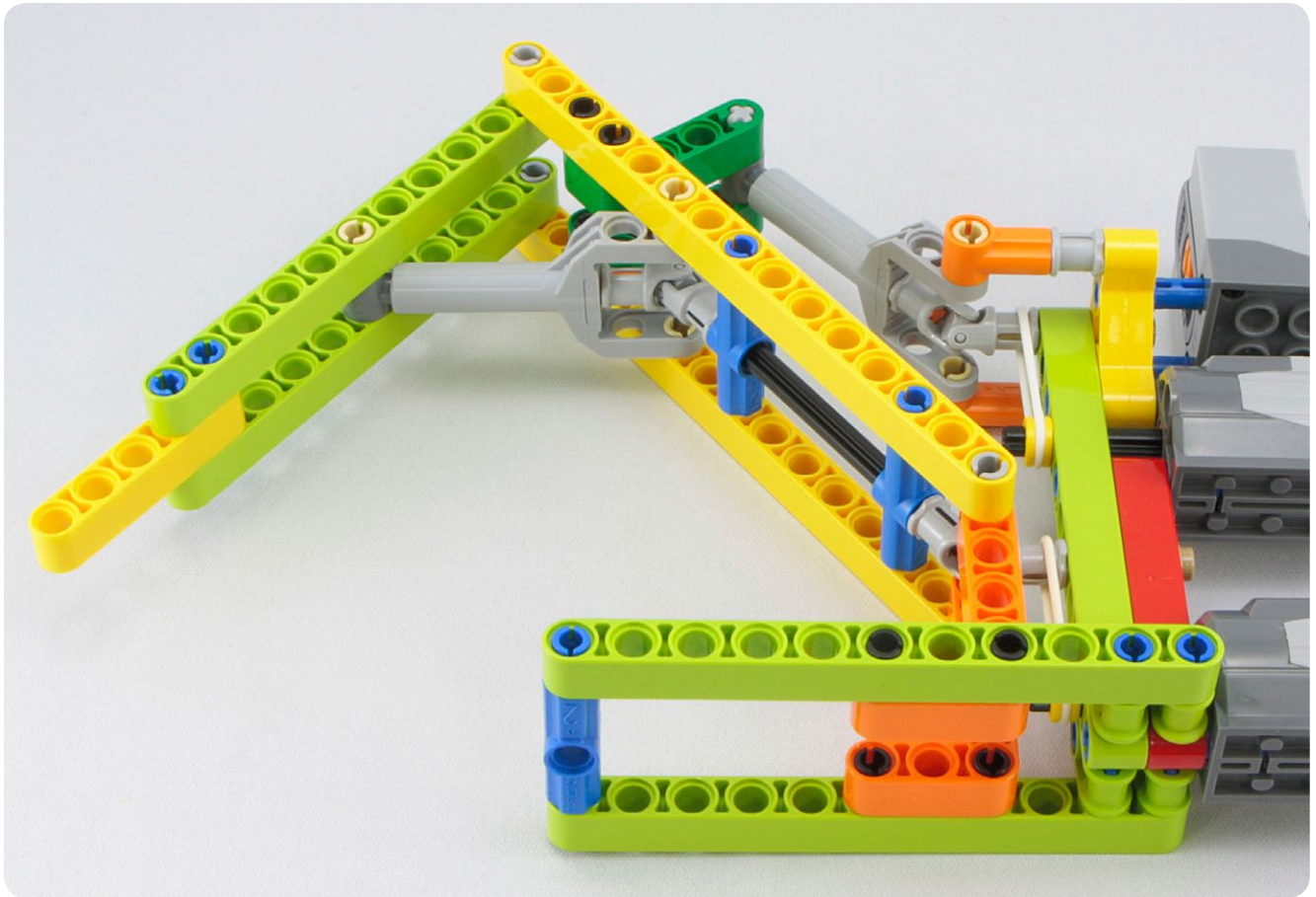


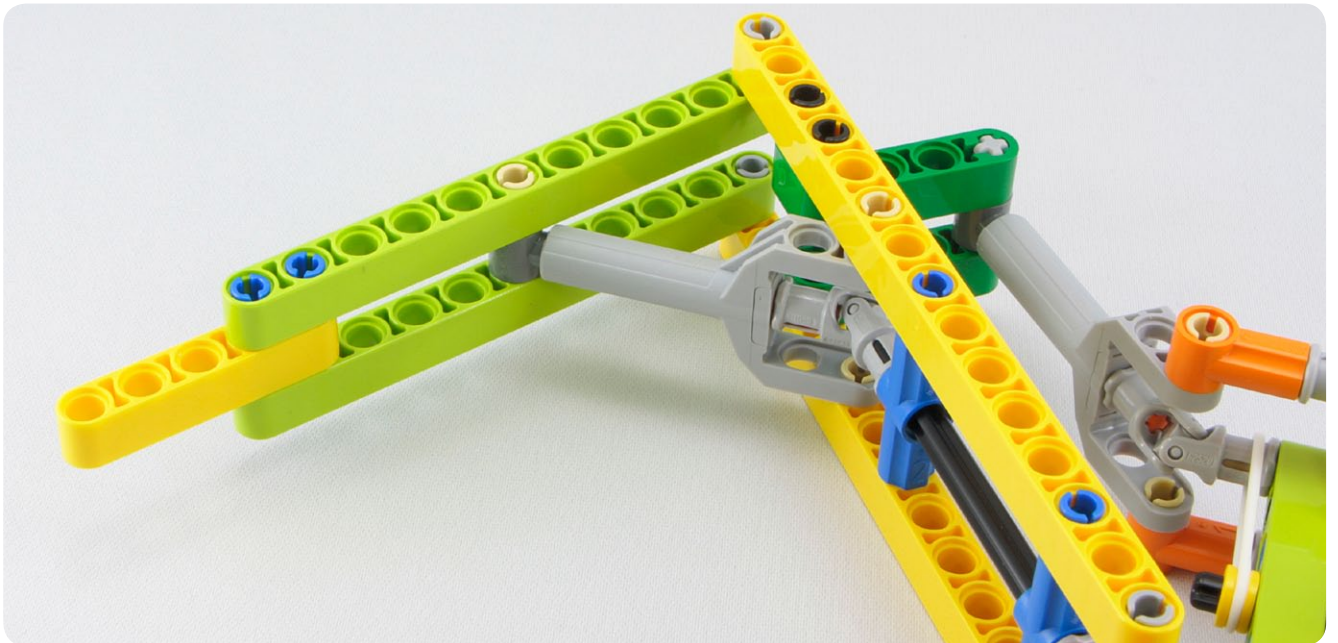
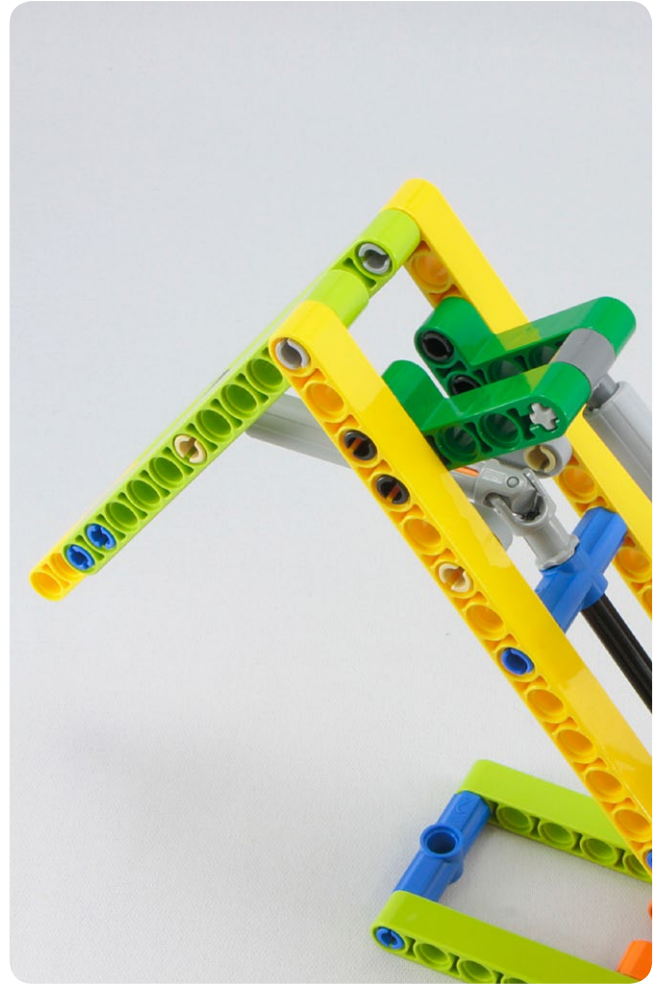


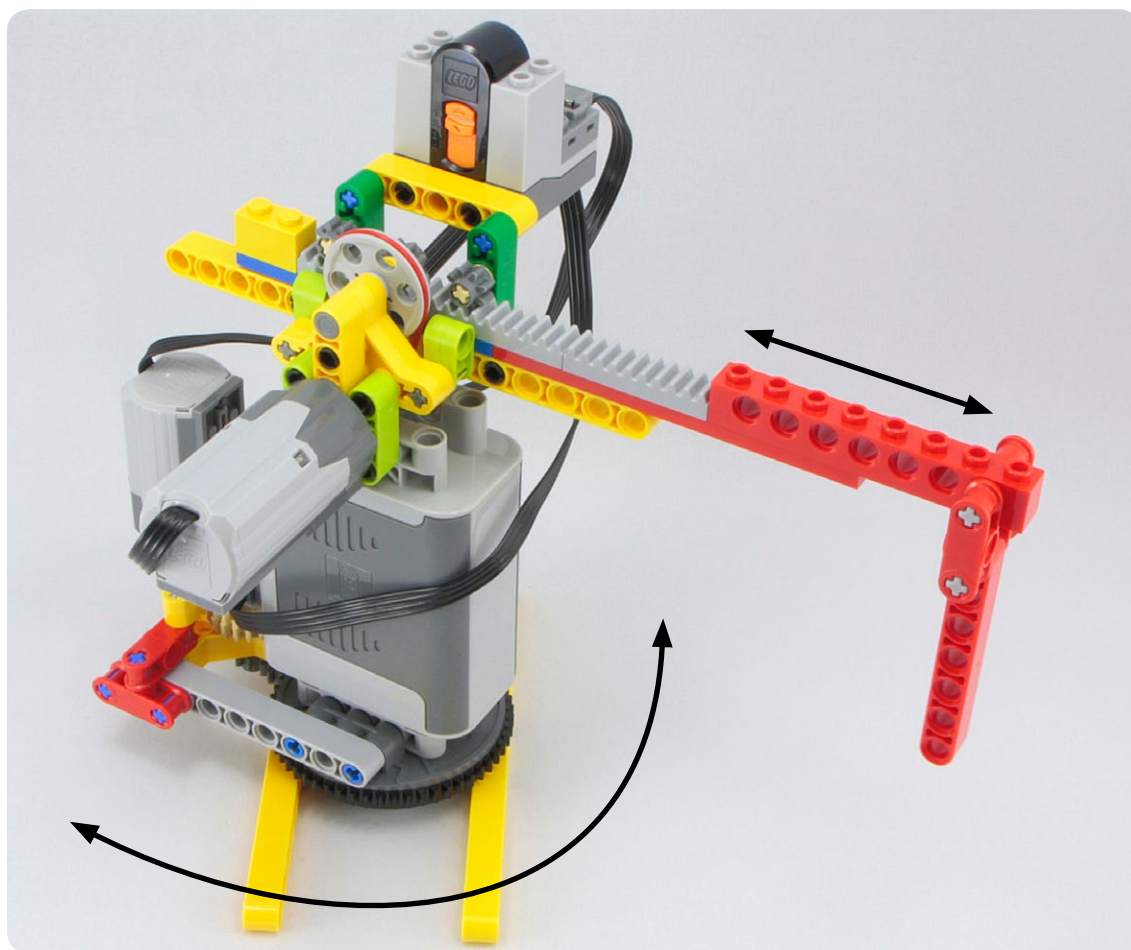


[illegible]



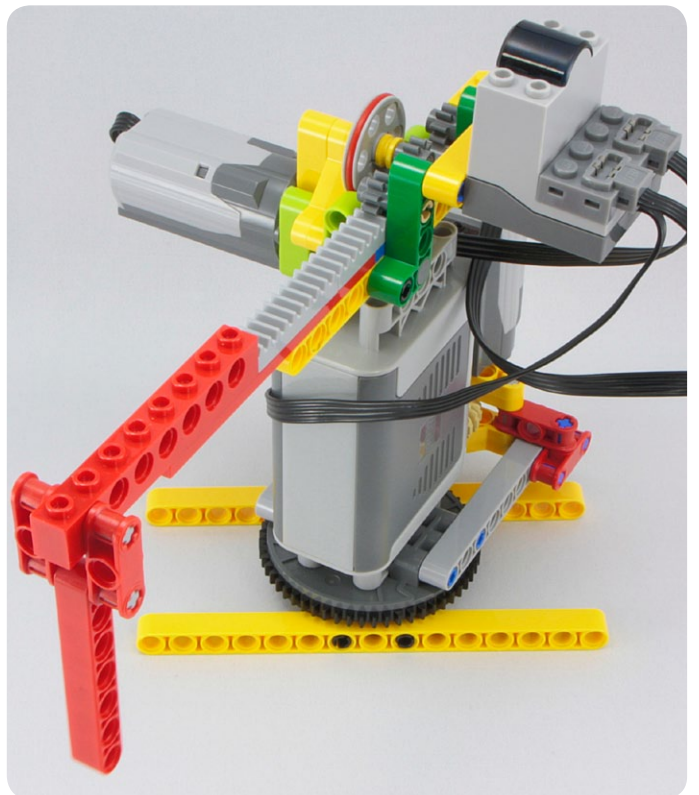
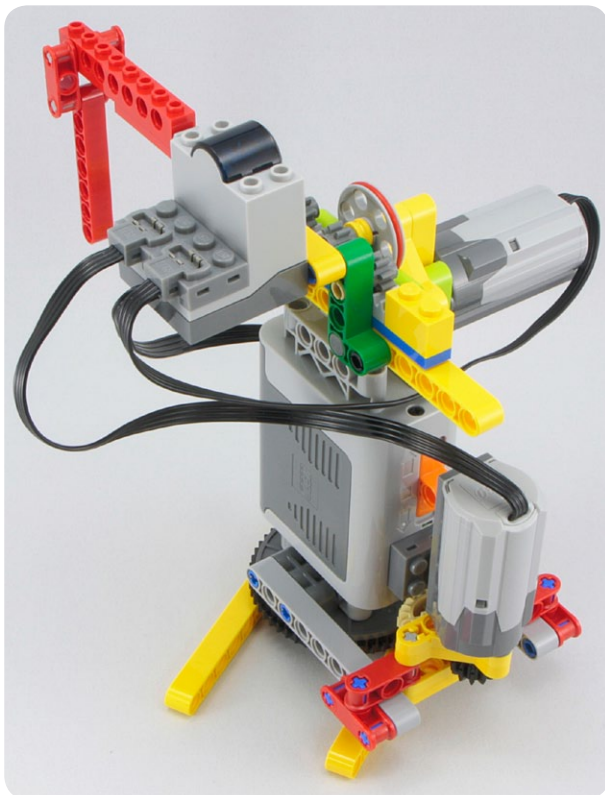


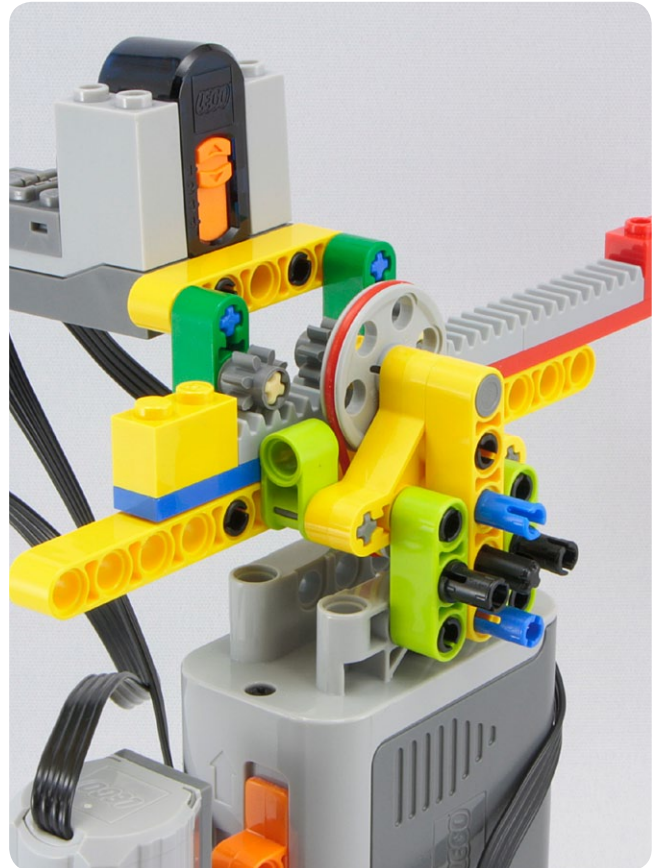
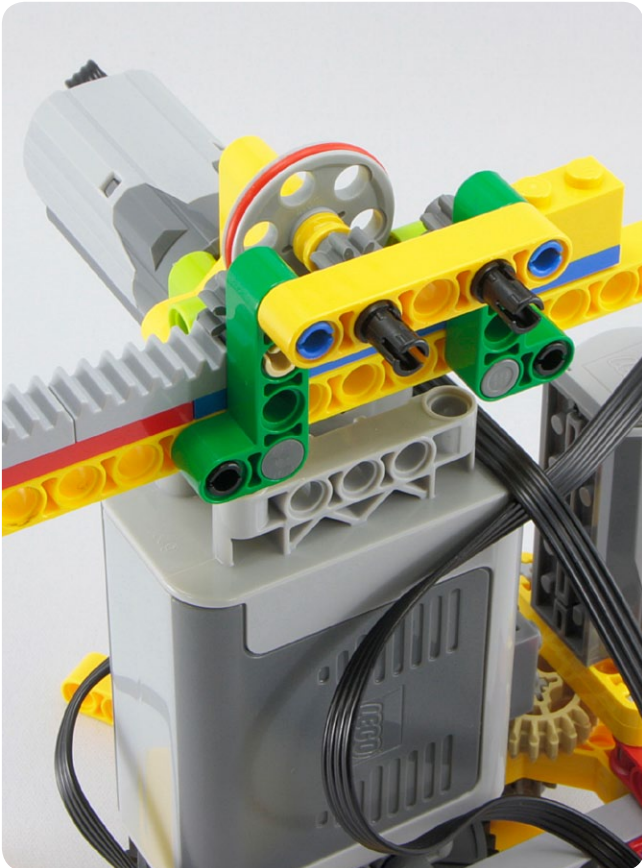
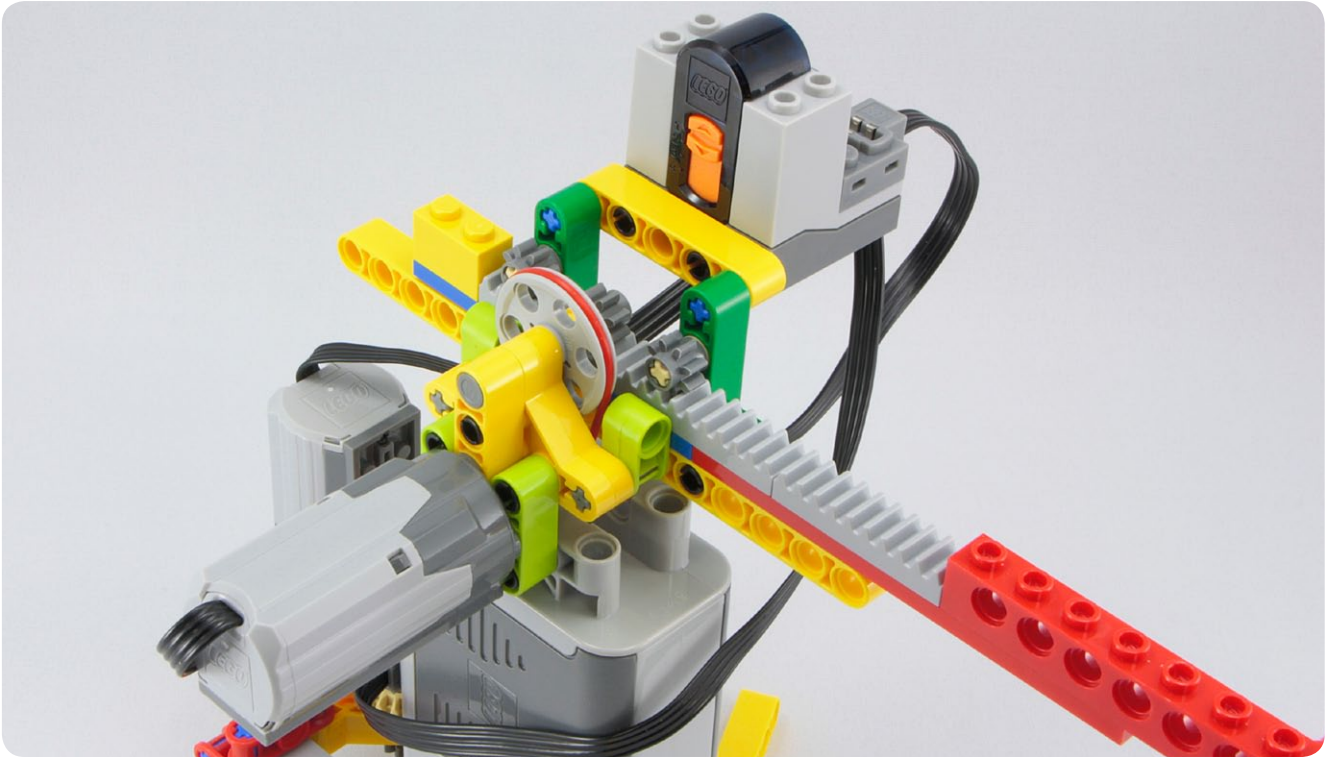


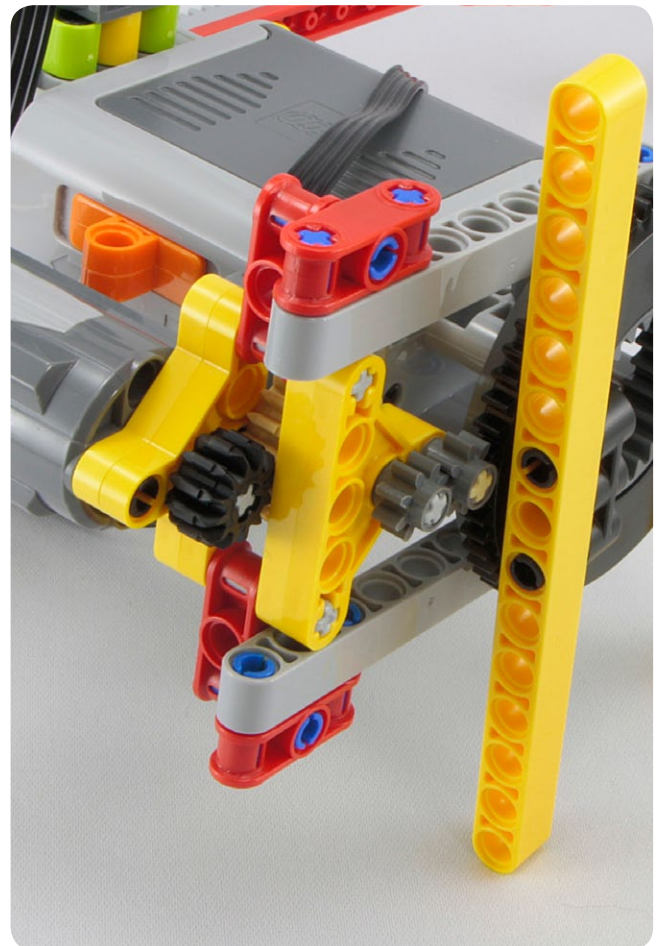
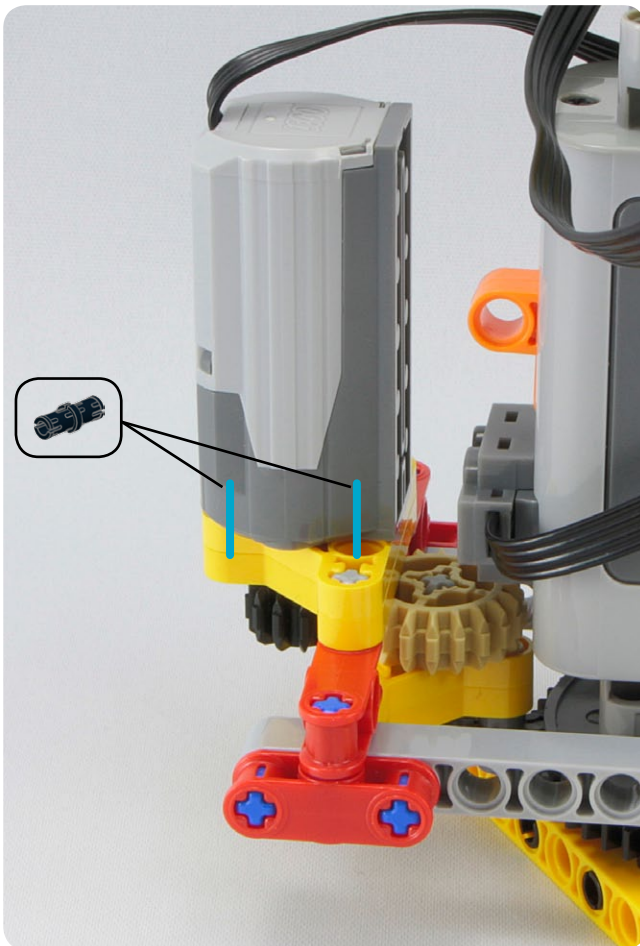
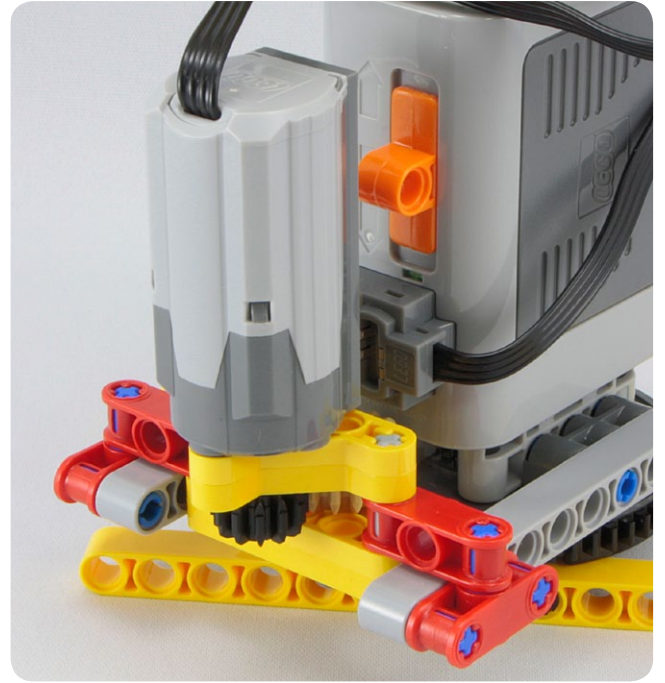
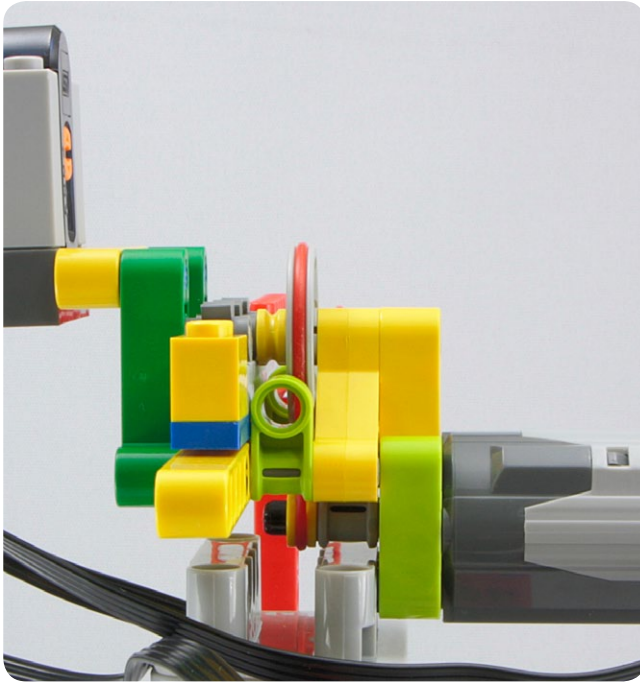
[illegible]

-  x6
 x4
 x3
 x2

 x6
 x3
 x8
 x17







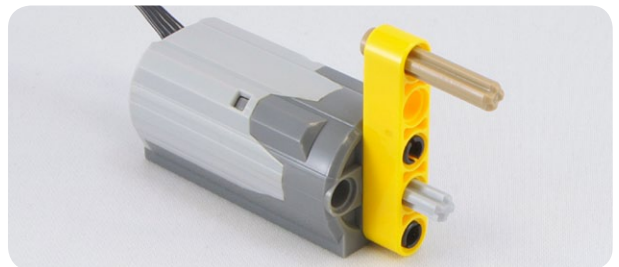
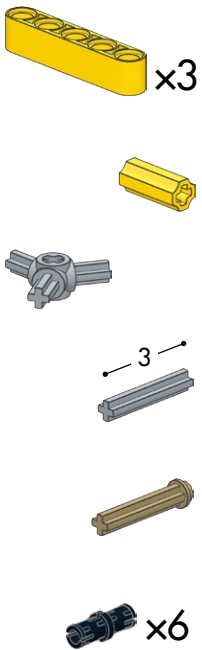
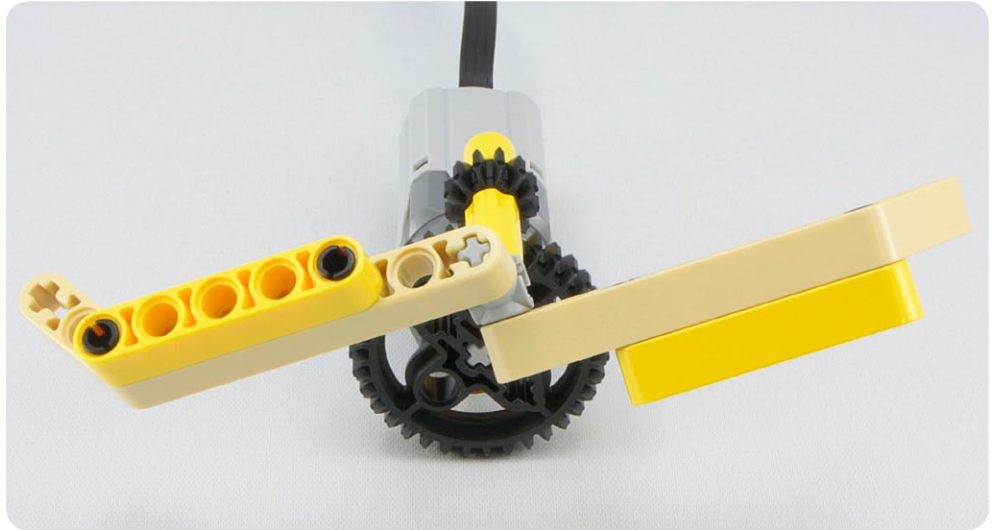


Caution!
These models spin.
Protect your eyes.

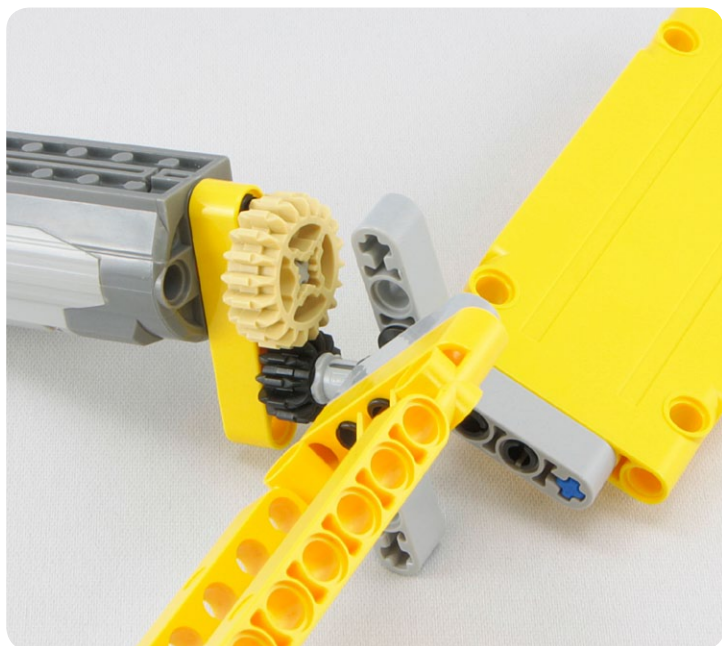
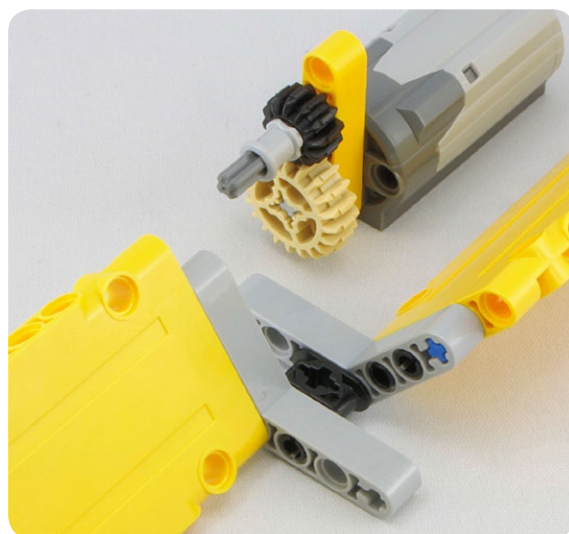
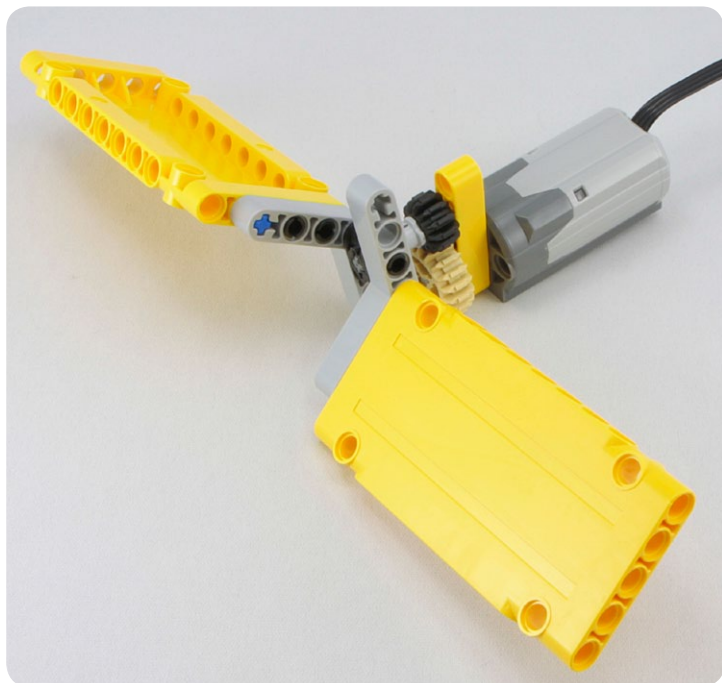
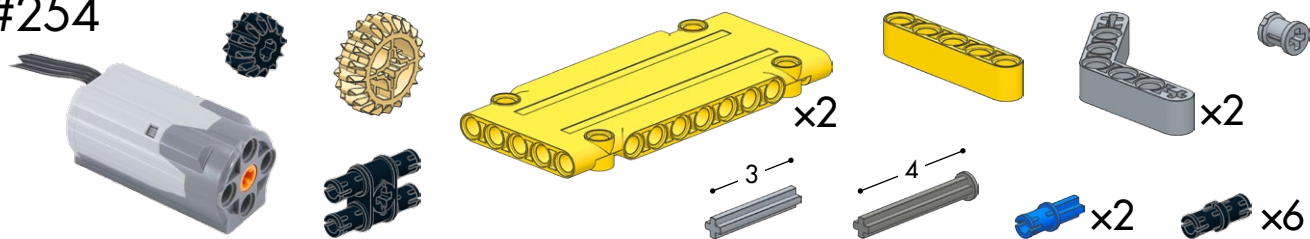


Spinning fans

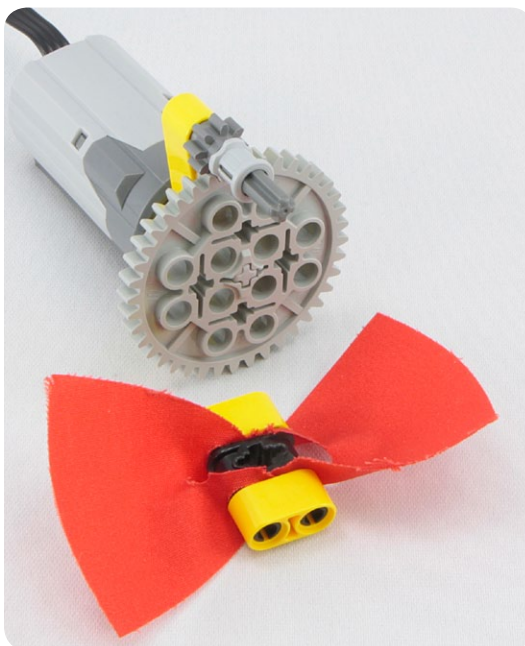
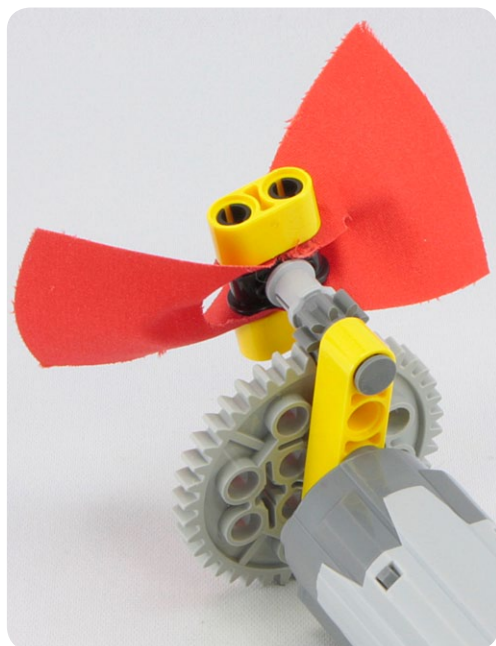
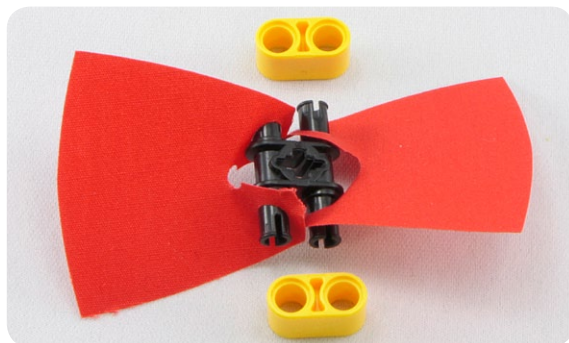
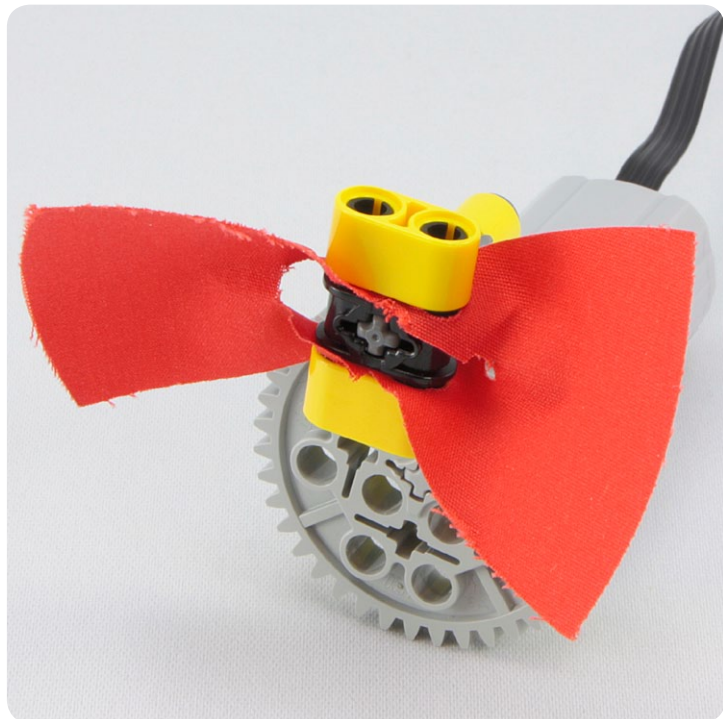
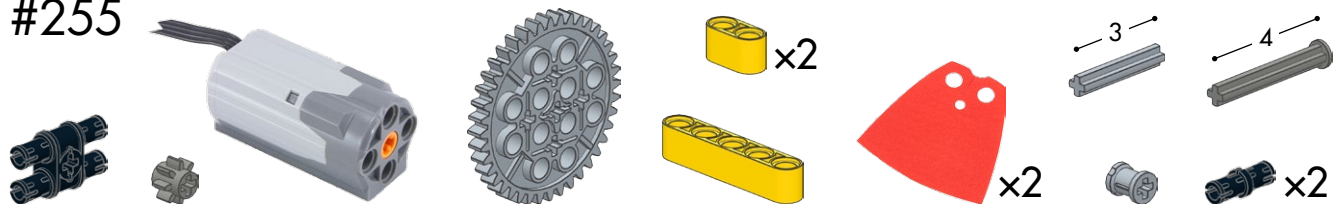
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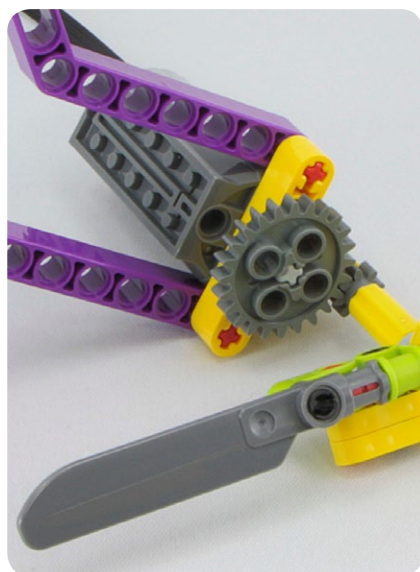
#254

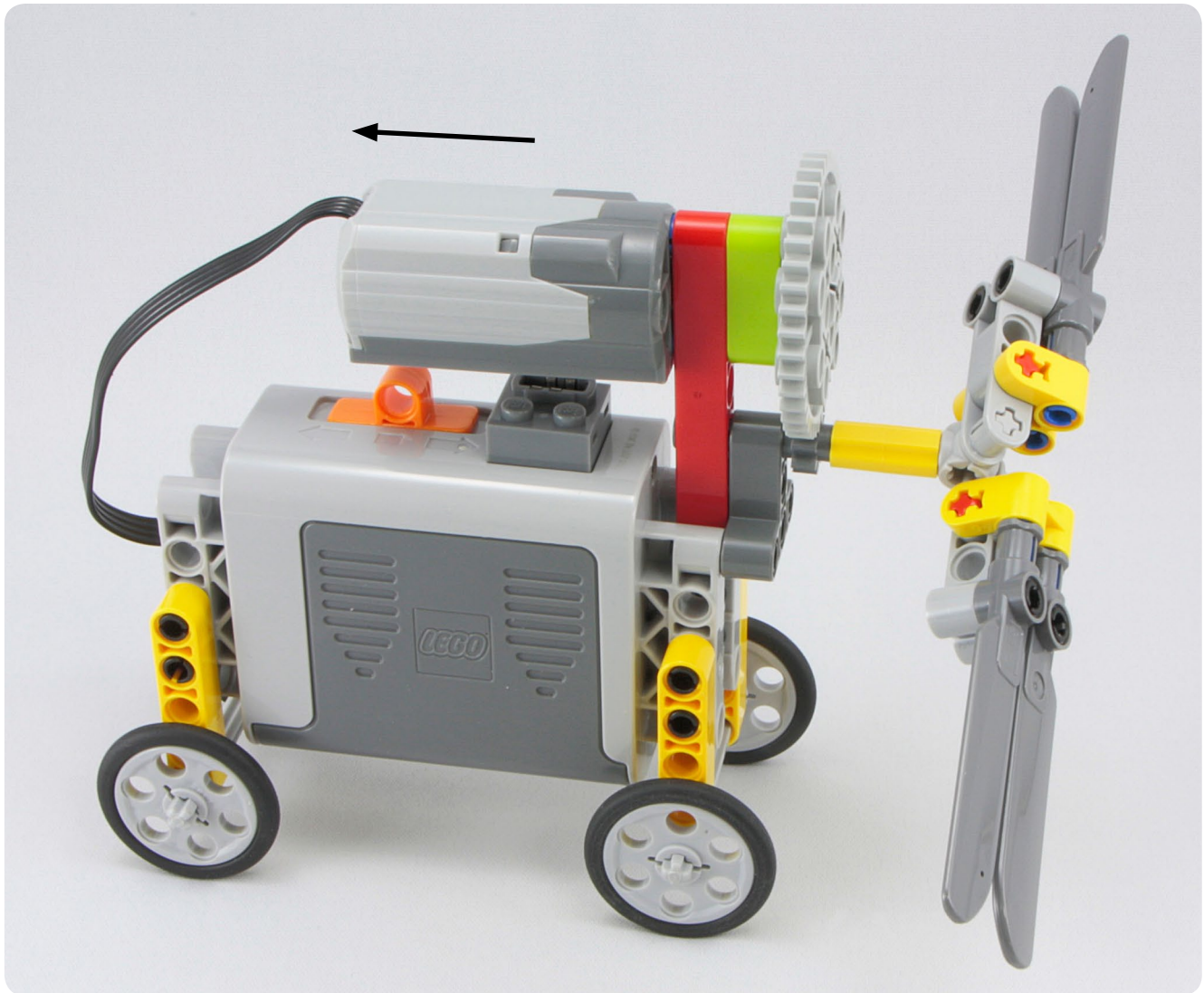


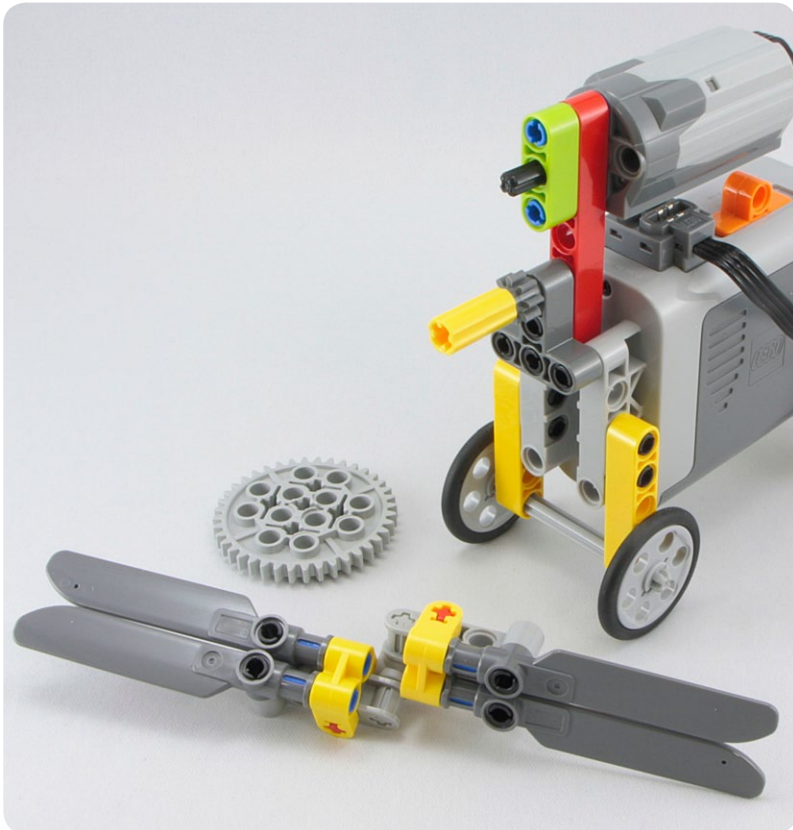
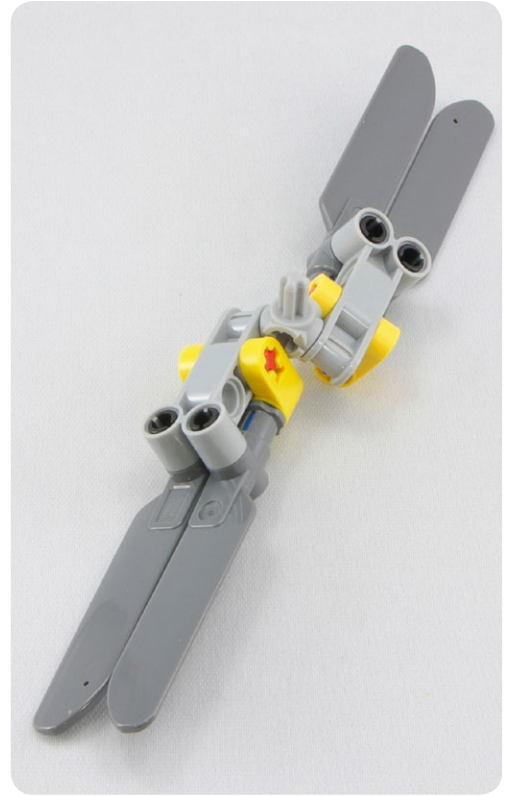
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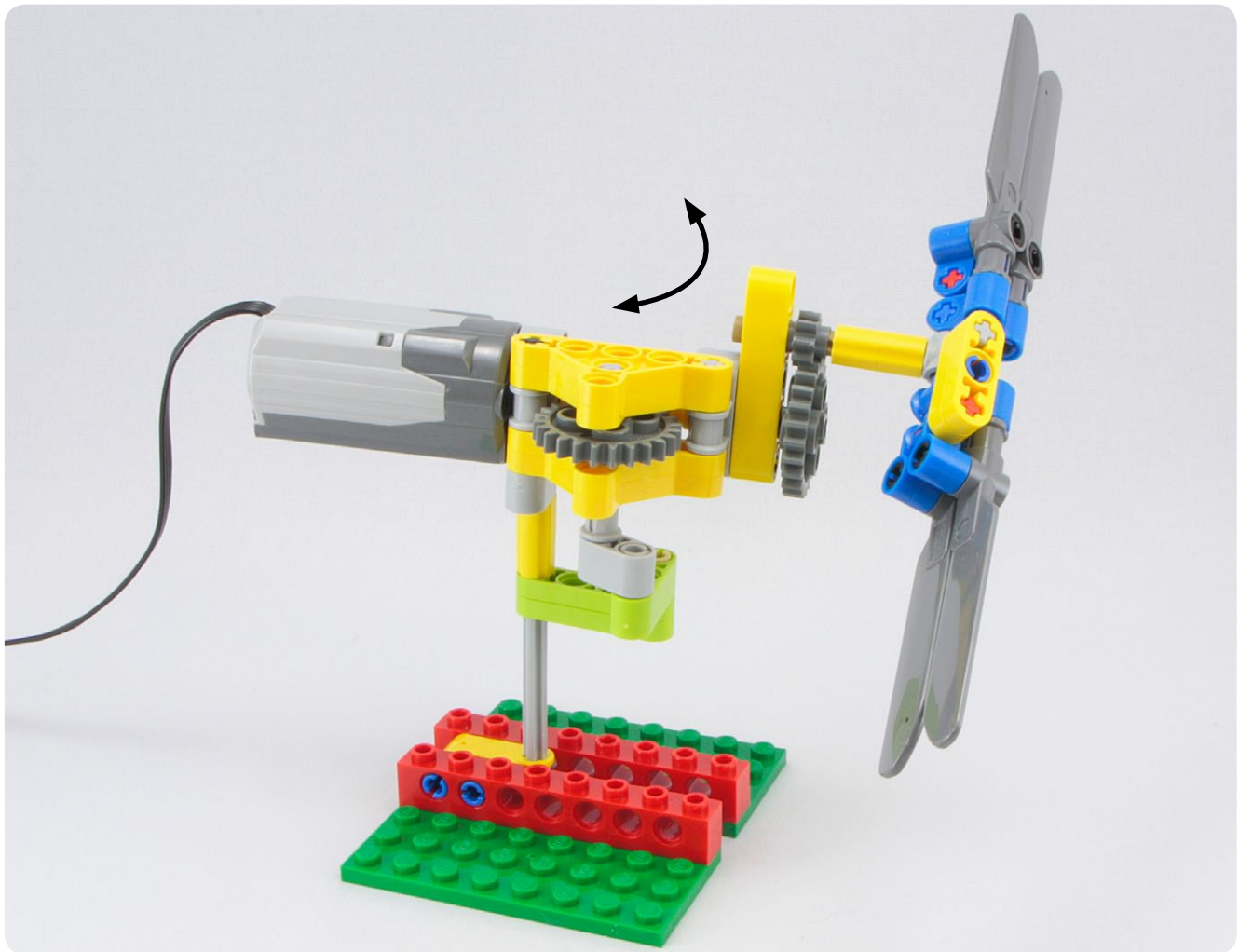


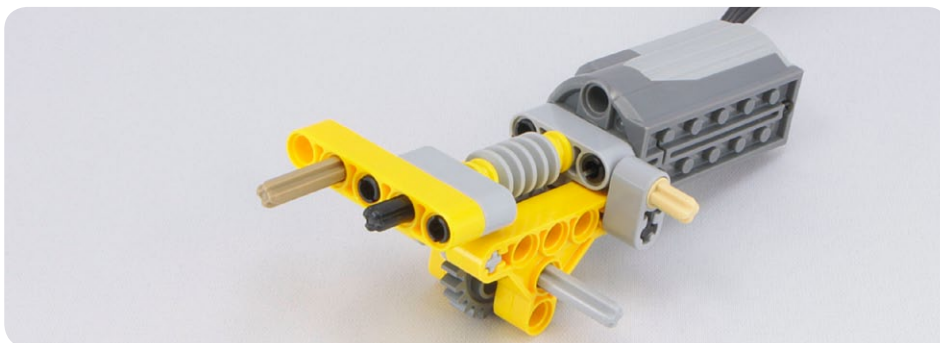
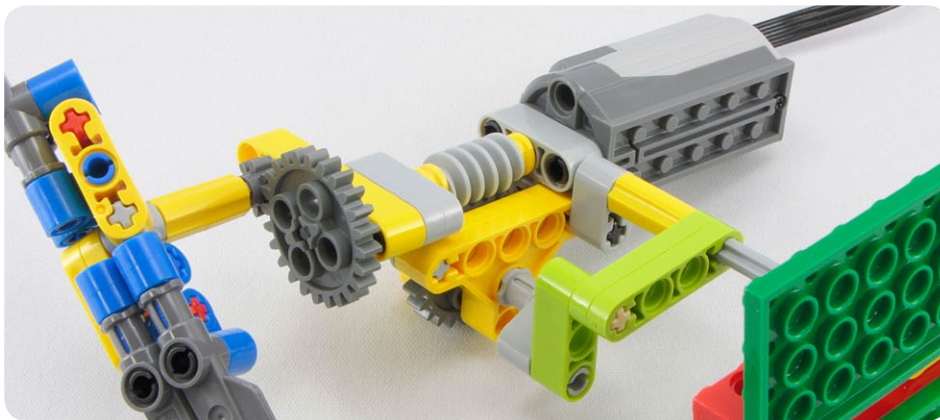
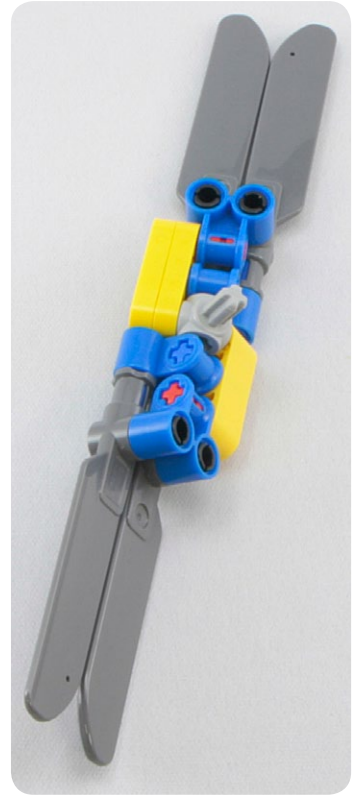
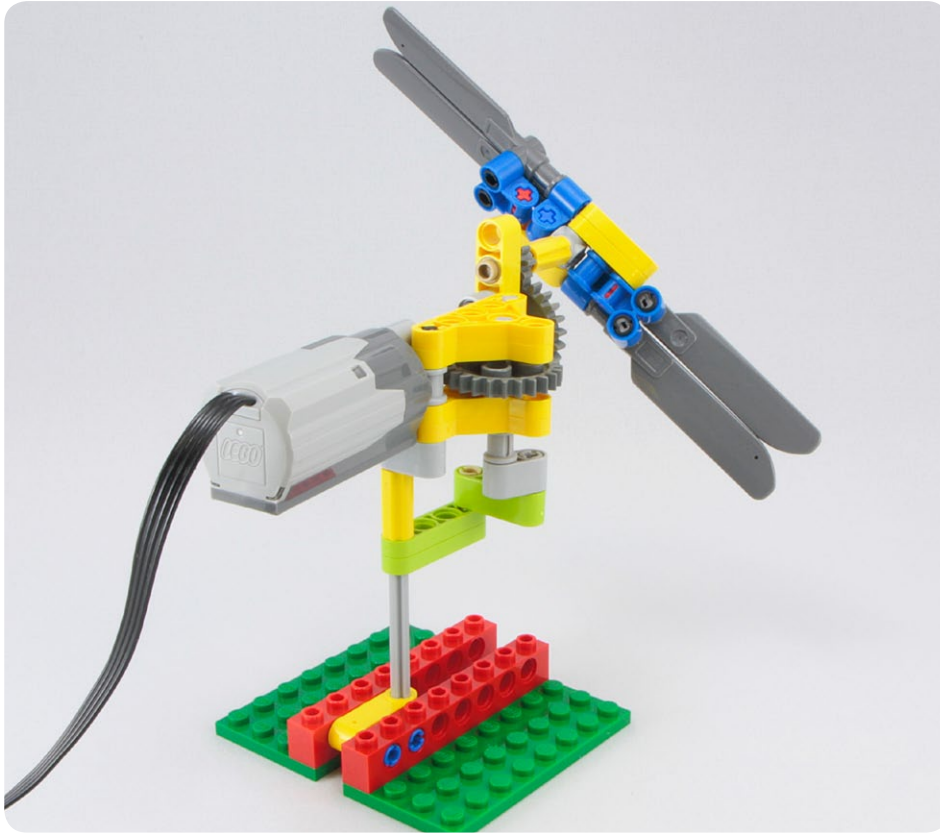
#256



[illegible]



[illegible]

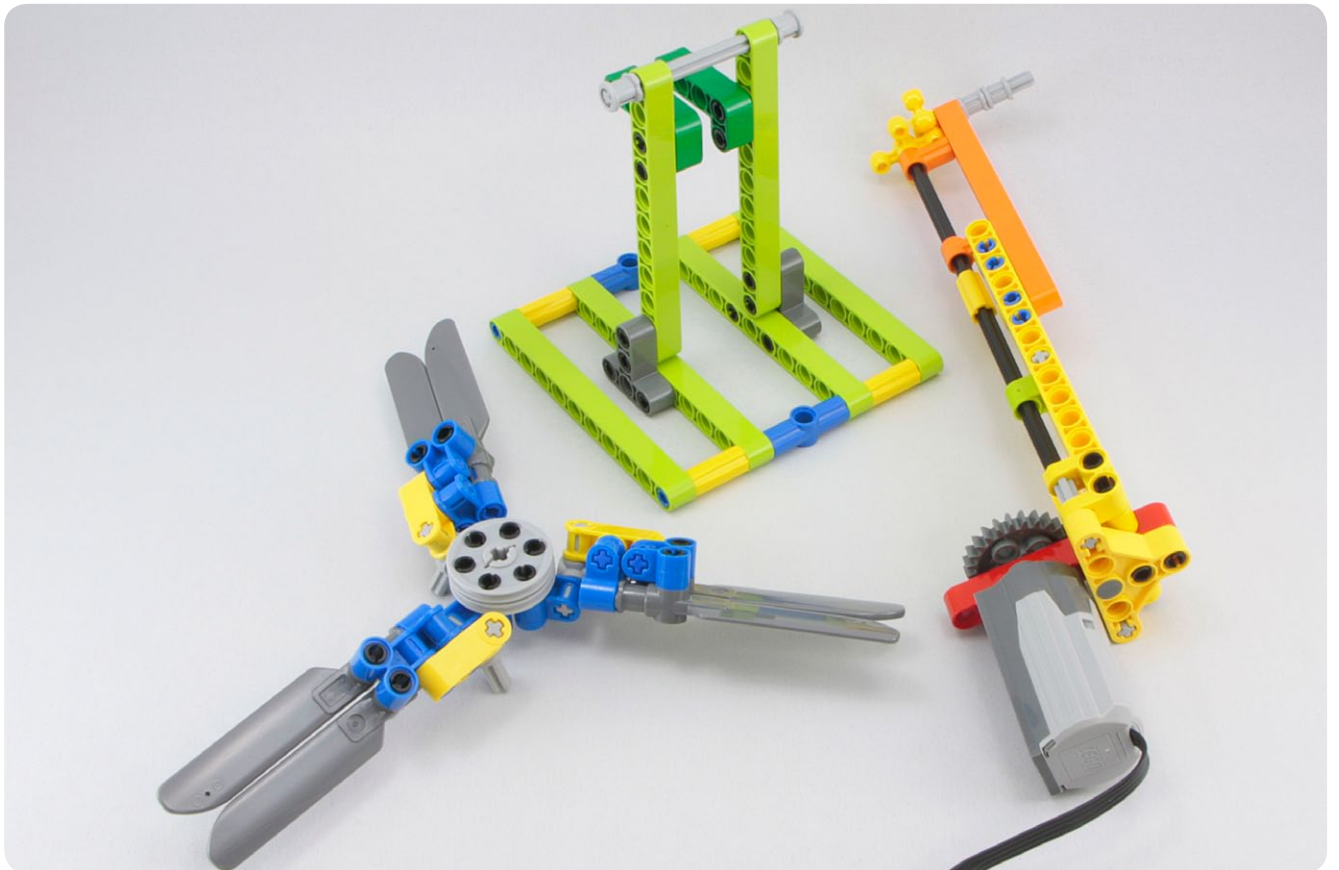


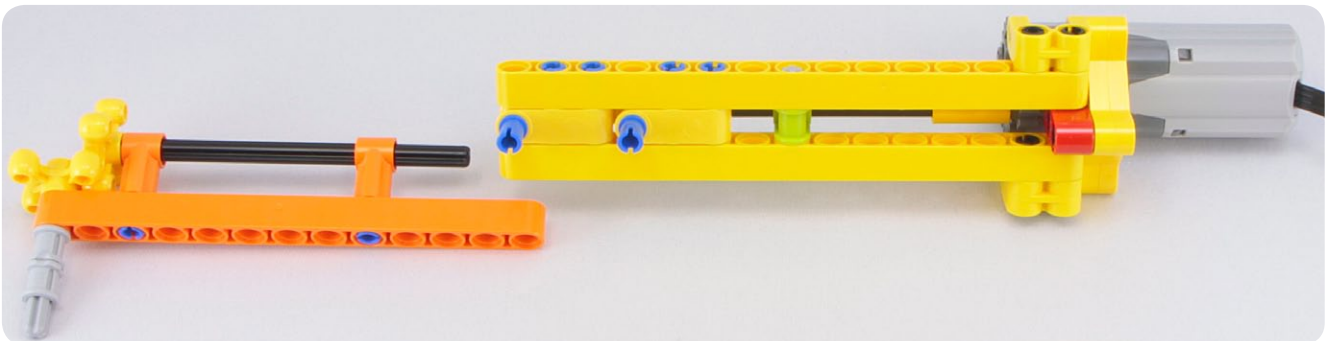
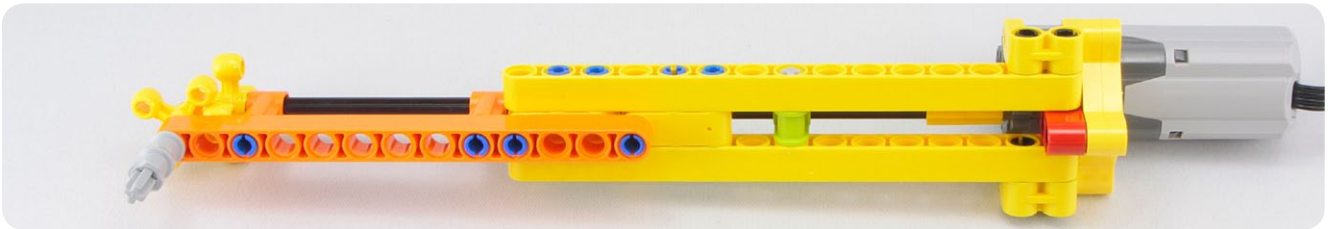
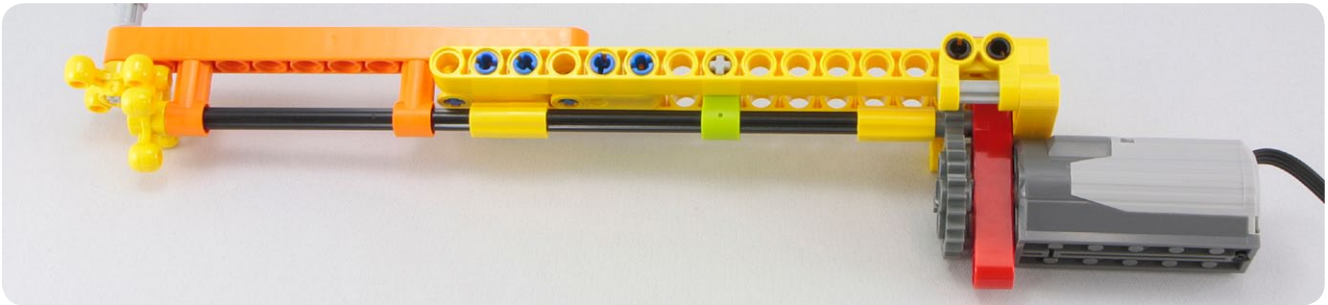
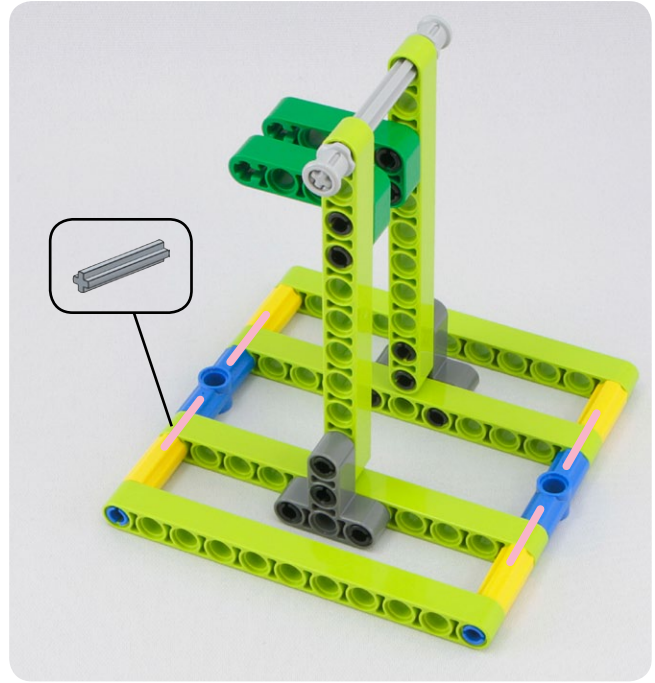
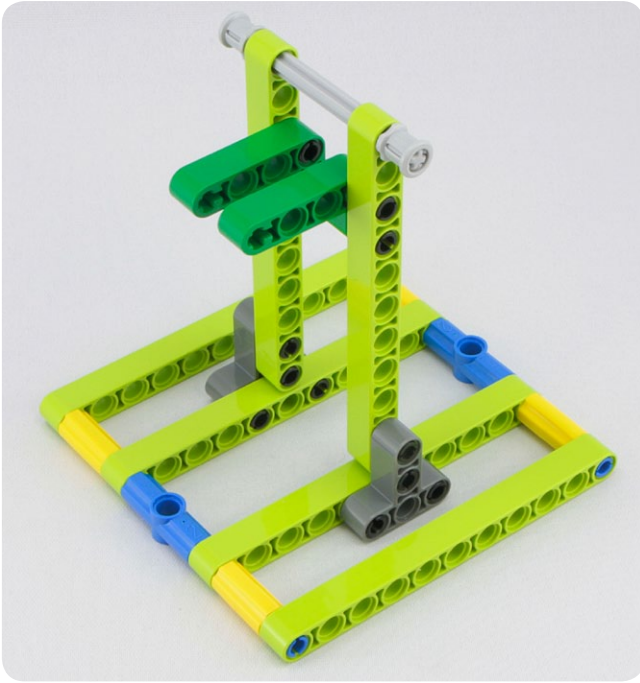
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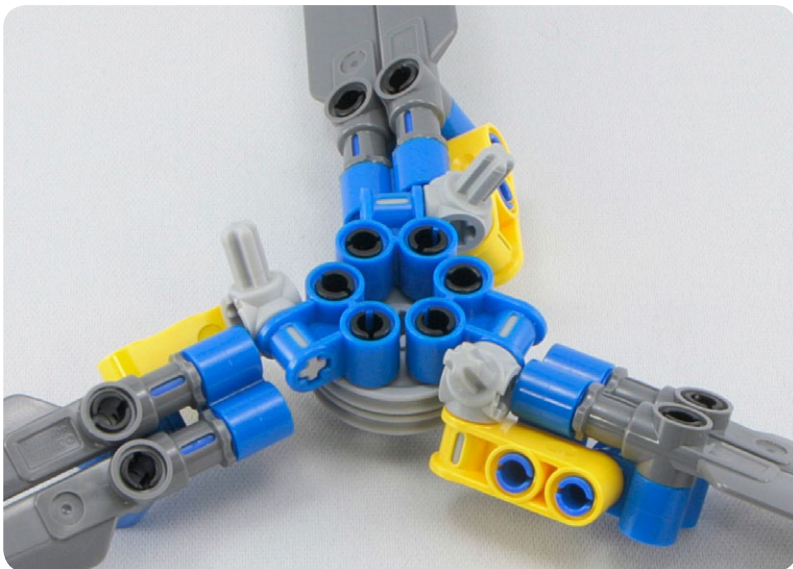
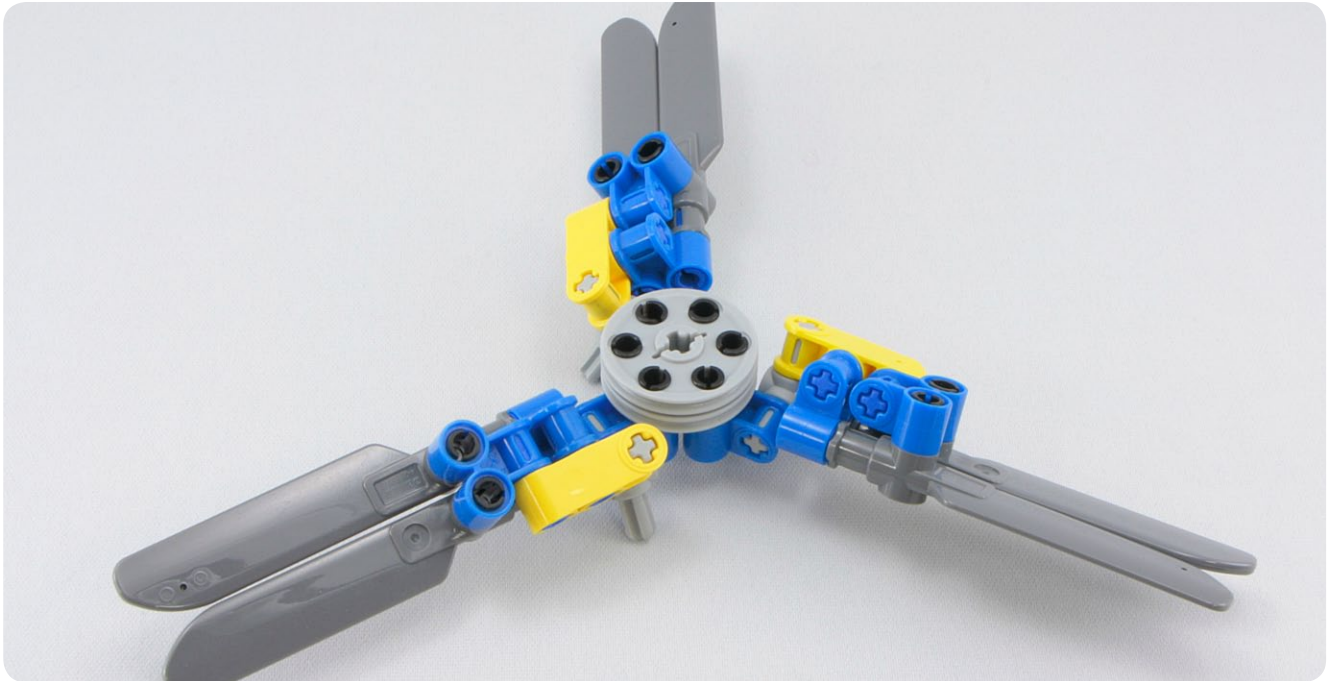
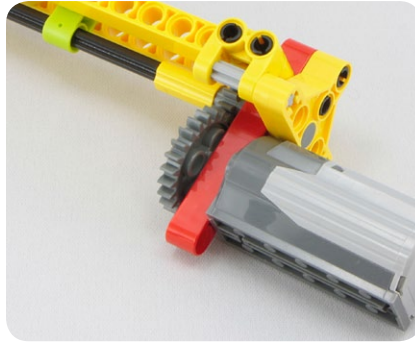
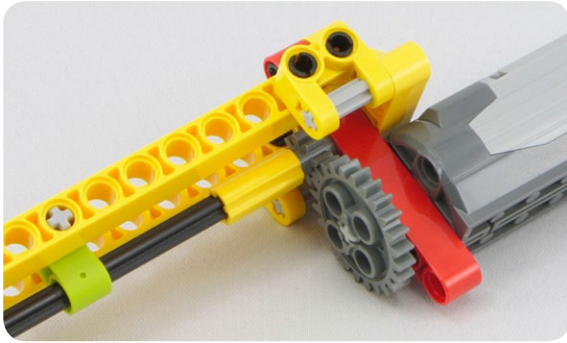
This image displays the LEGO parts required for step 259. The parts are arranged in a grid-like fashion, each labeled with its quantity. The parts include:

- Yellow Technic Beam 1x10 (x2)
- Orange Technic Beam 1x10 (x2)
- Light Green Technic Beam 1x10 (x6)
- Red Technic Beam 1x10 (x1)
- Grey Motor (x1)
- Green L-shaped Technic Connector (x2)
- Grey T-shaped Technic Connector (x2)
- Yellow L-shaped Technic Connector (x2)
- Blue 3-Way Technic Connector (x9)
- Yellow 3-Way Technic Connector (x5)
- Black Gear (x1)
- Small Grey Pin (x1)
- White Wheel (x2)
- Yellow 2-Way Technic Connector (x2)
- Grey Axle (length 5) (x1)
- Grey Axle (length 7) (x1)
- Grey Axle (length 10) (x2)
- Blue Pin (x4)
- Blue Pin (x20)
- Black Pin (x32)
- Grey Pin (length 3) (x8)
- Grey Pin (length 4) (x1)
- Grey Pin (length 7) (x1)
- Grey Pin (length 10) (x1)
- Blue Pin (x4)
- Blue Pin (x20)
- Black Pin (x32)
- Yellow 4-Way Technic Connector (x2)
- Yellow Pin (x6)
- Grey Pin (x3)
- Orange Pin (x2)
- Blue Pin (x2)
- Grey Pin (x6)





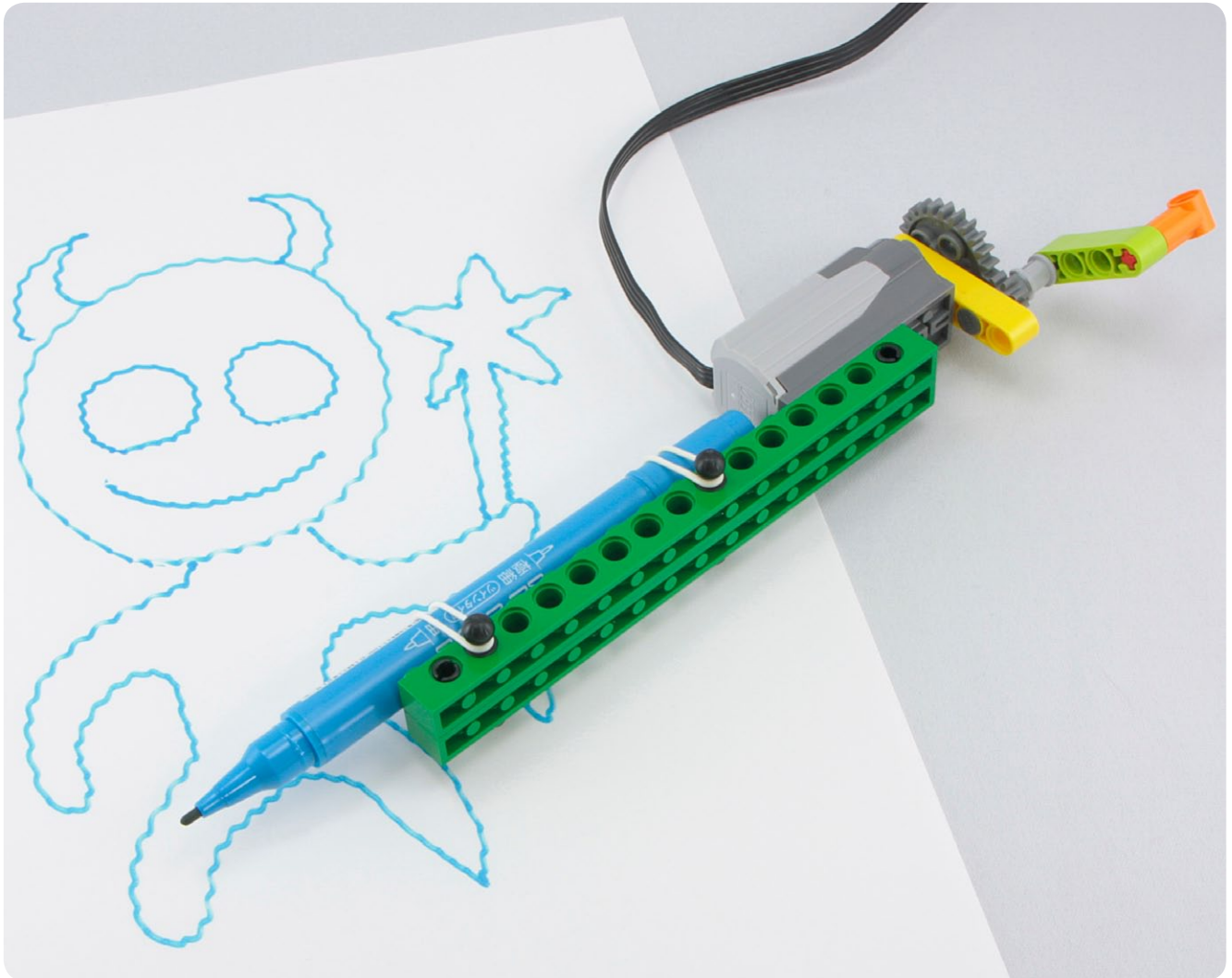
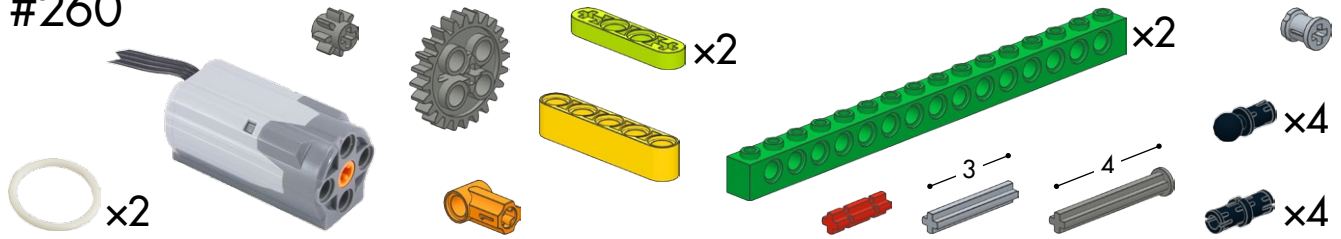


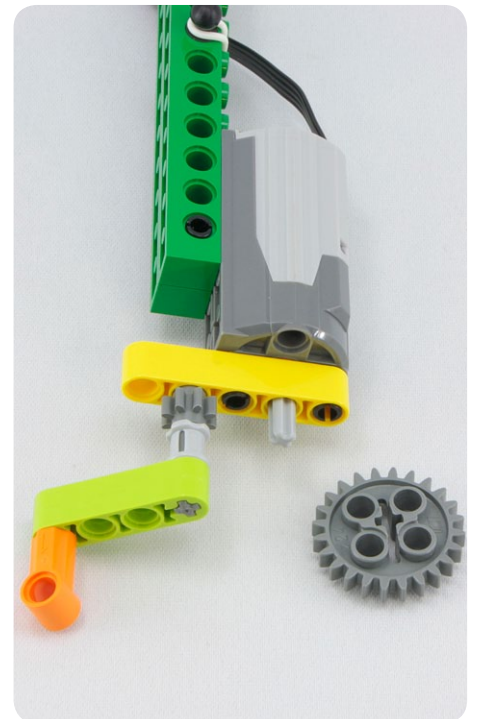
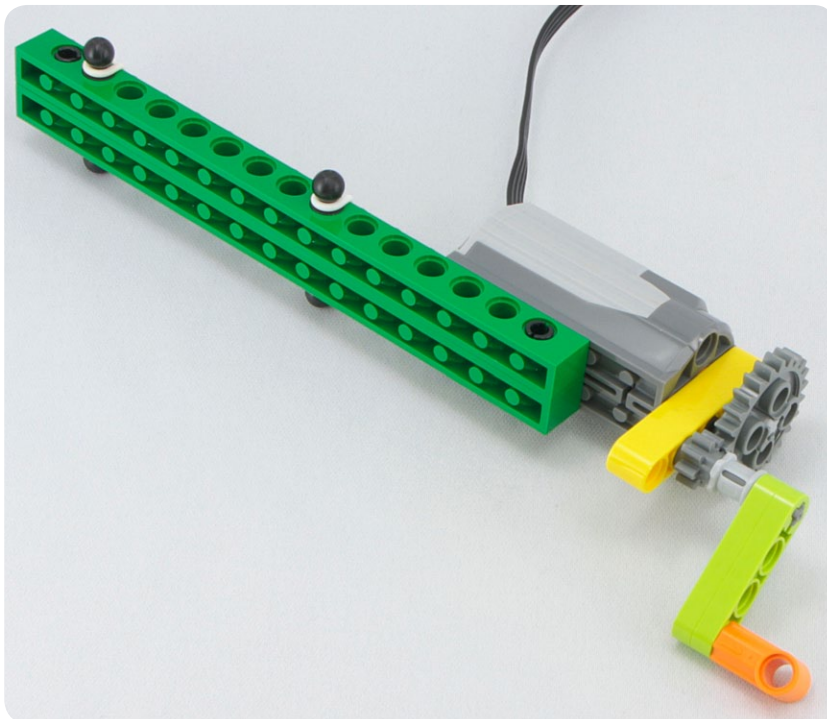
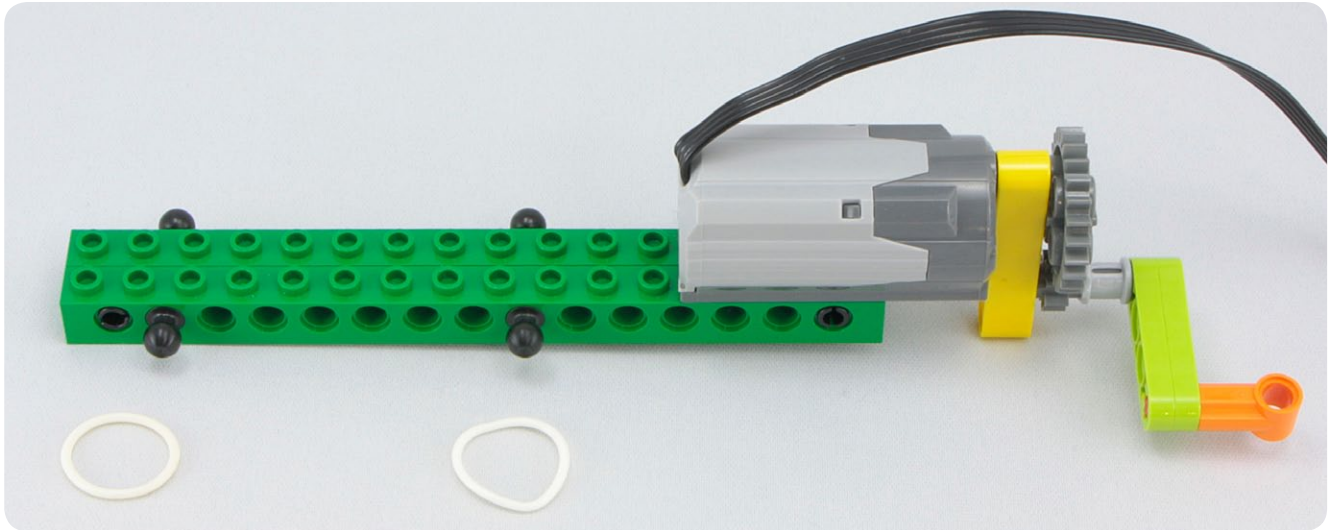
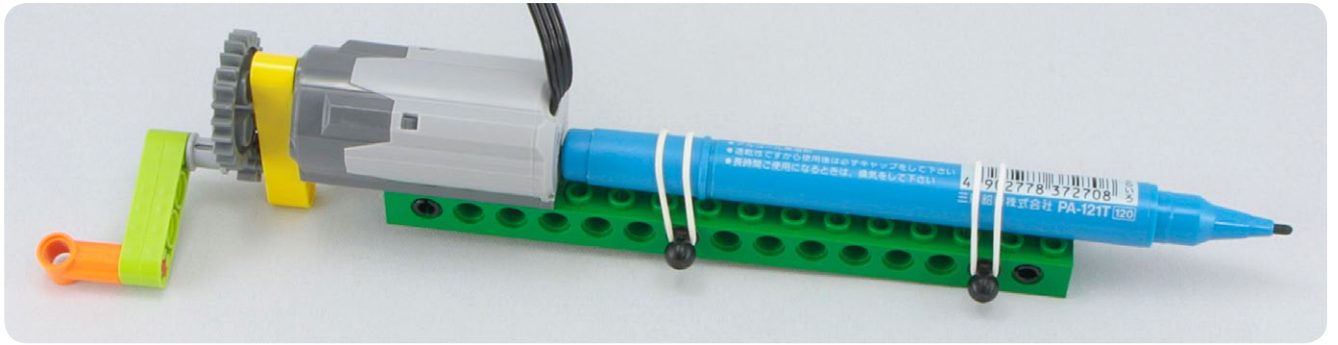




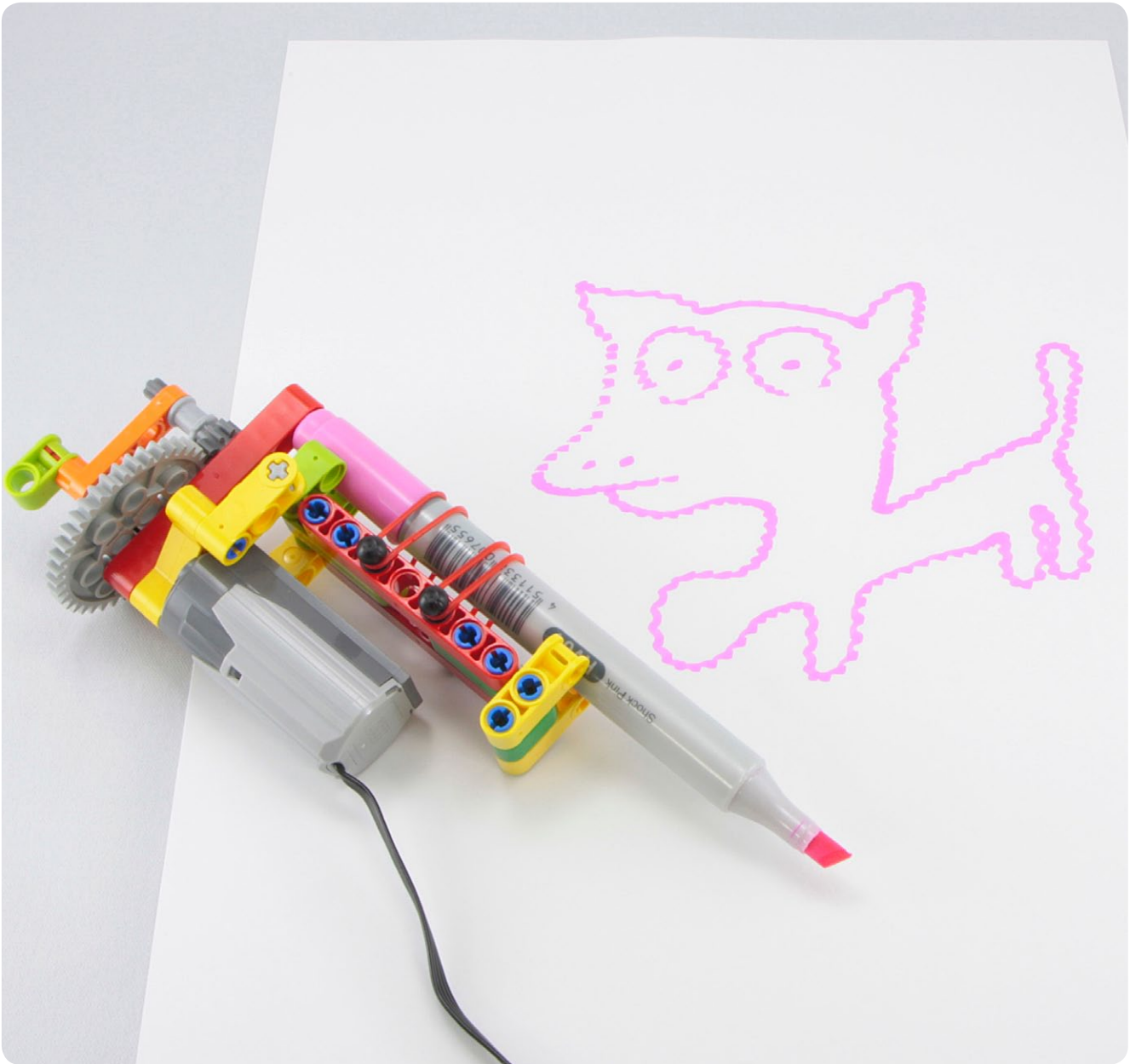
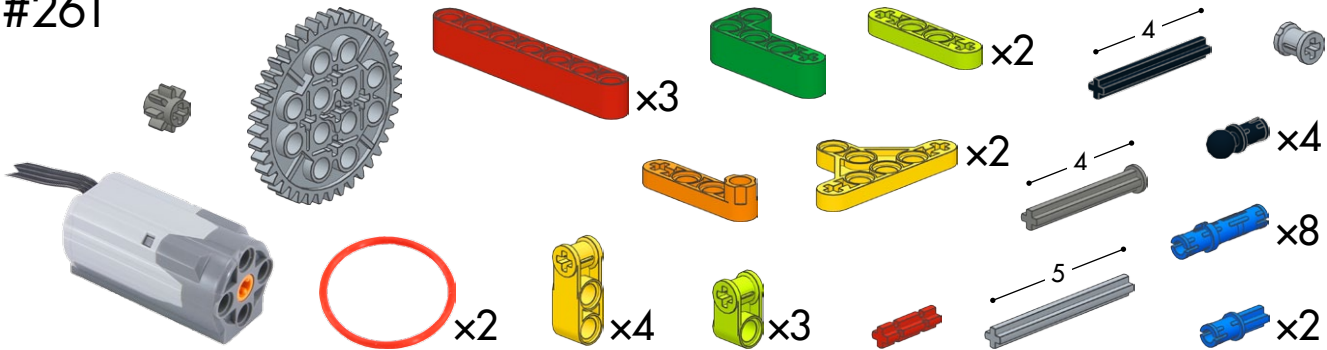
Drawing pictures

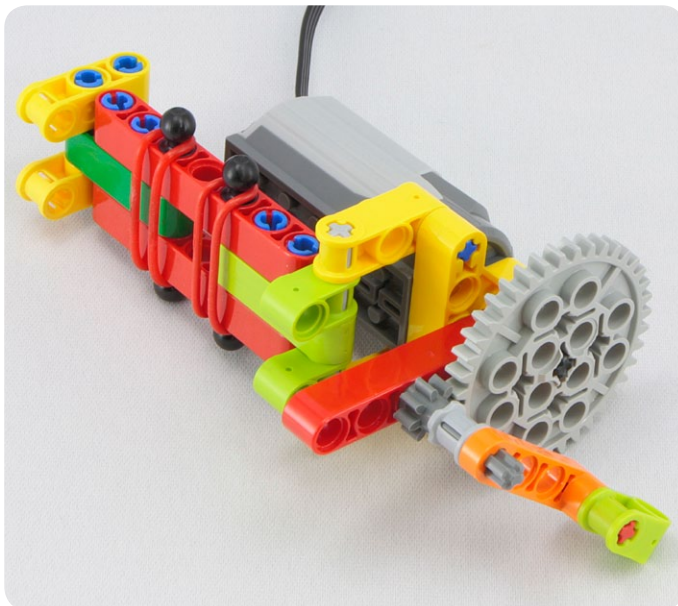
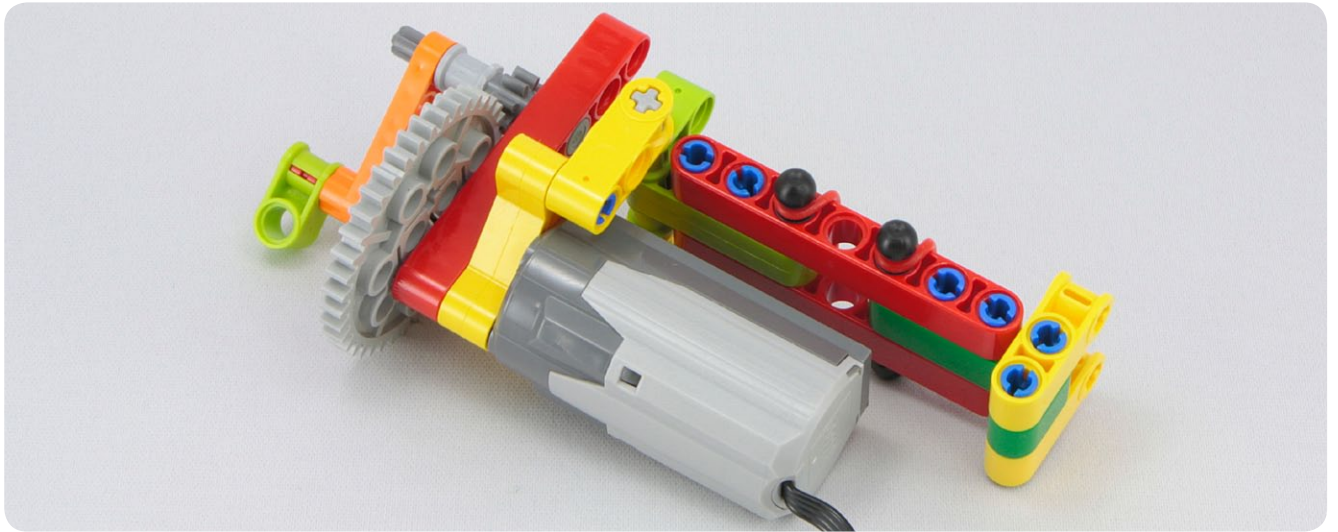
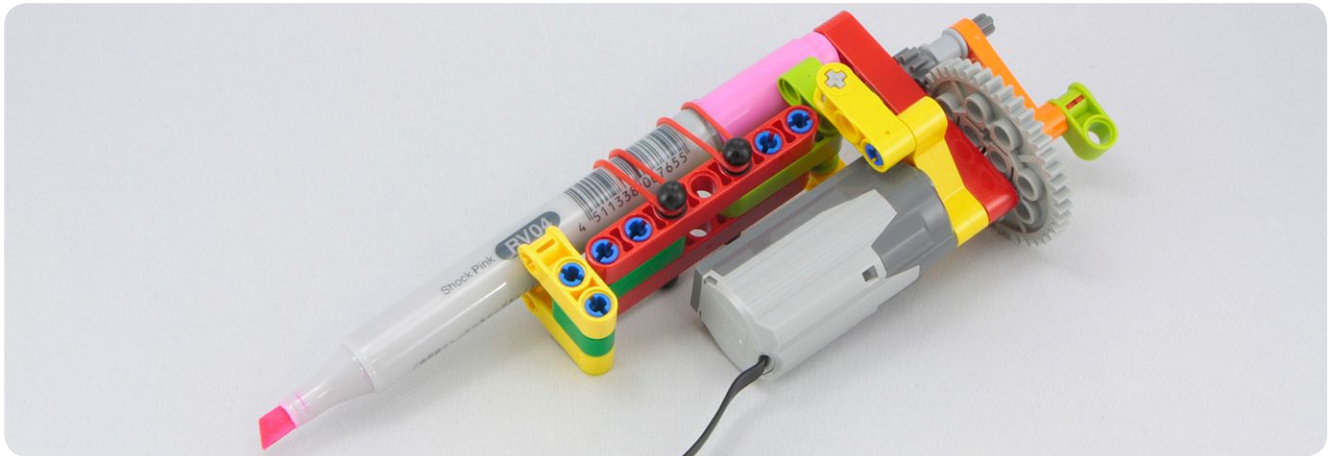
#260



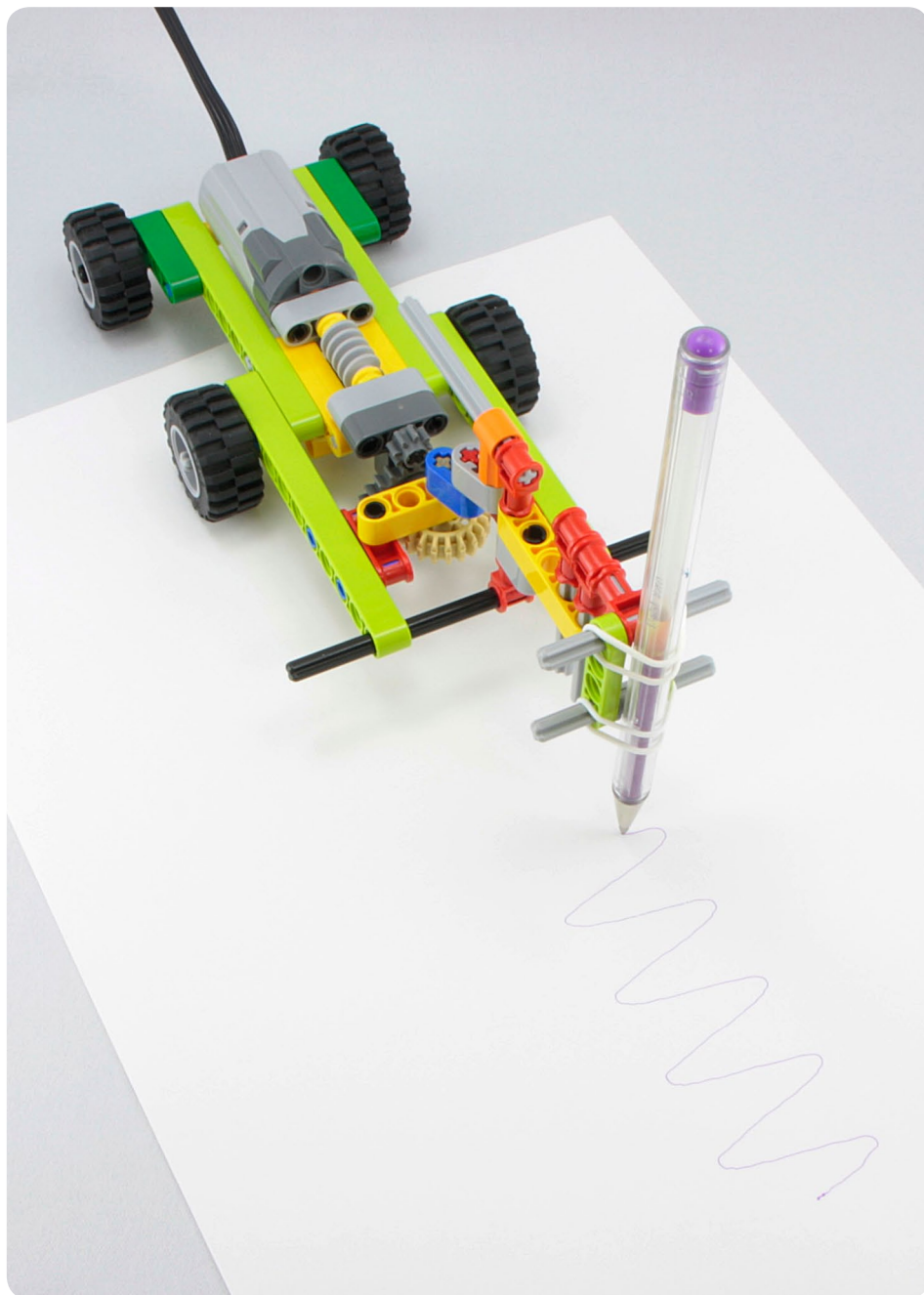
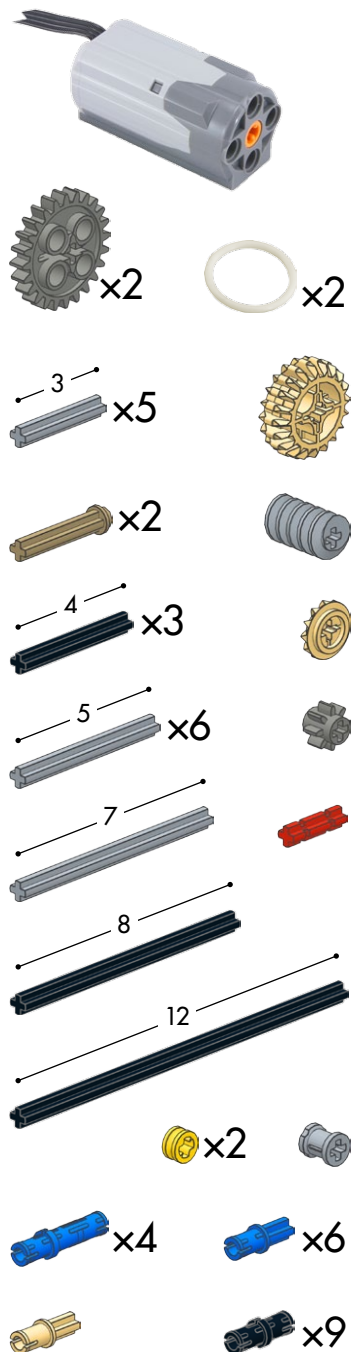
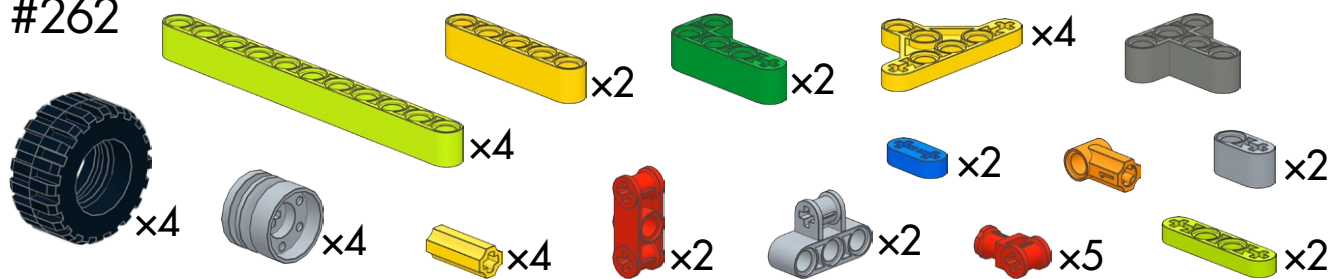


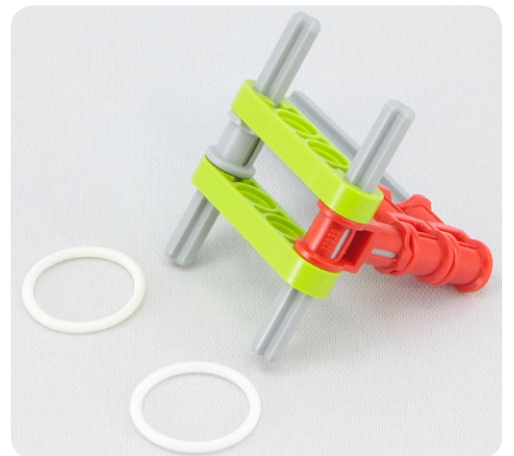
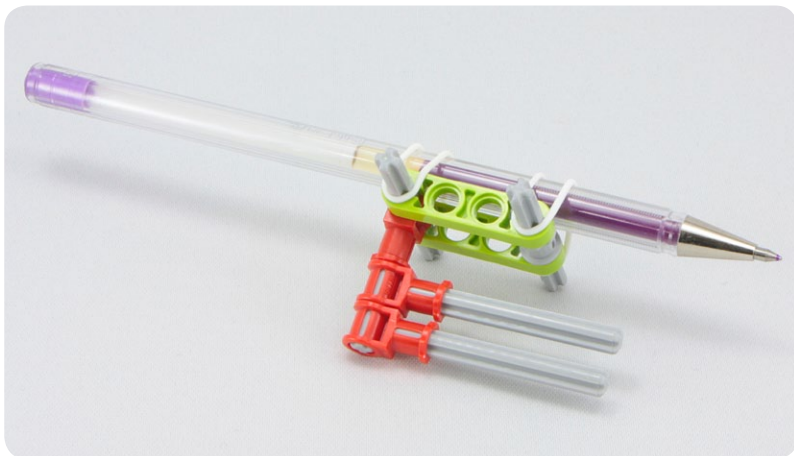
#261

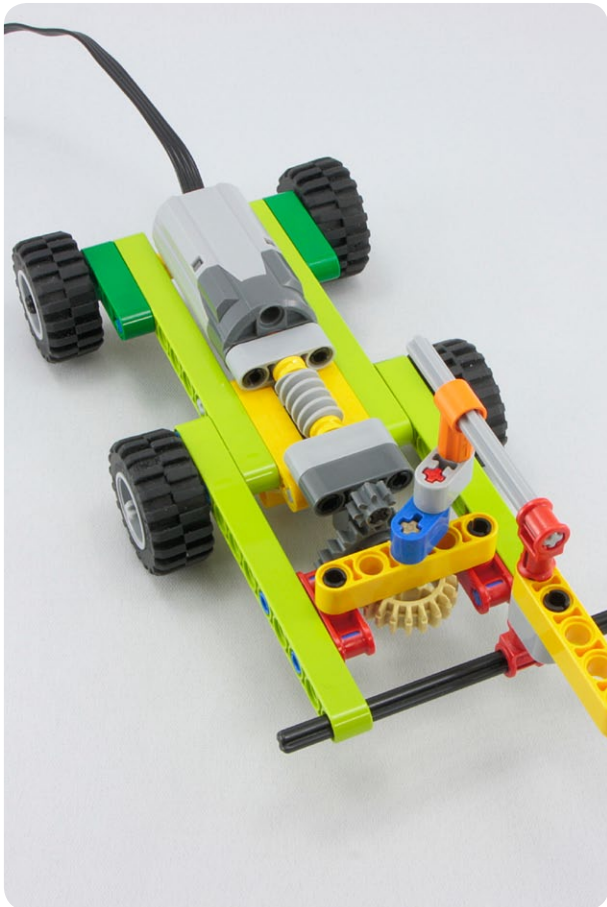
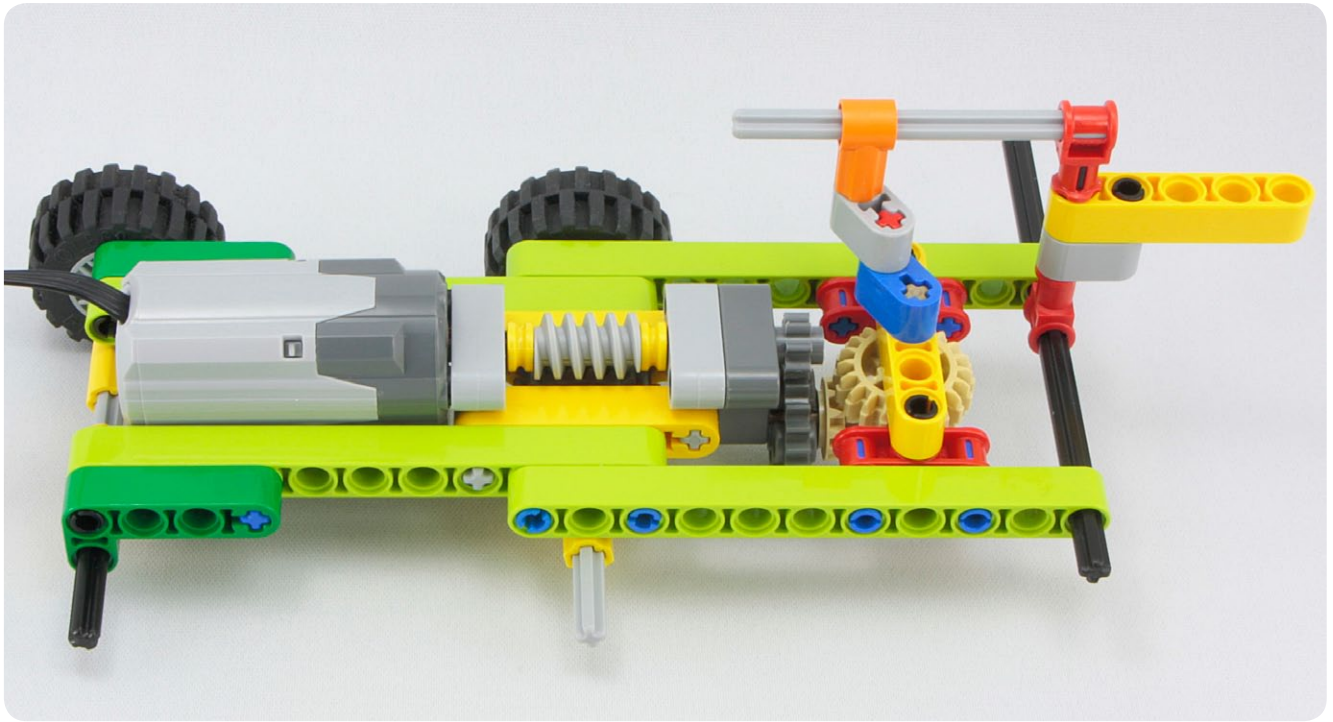


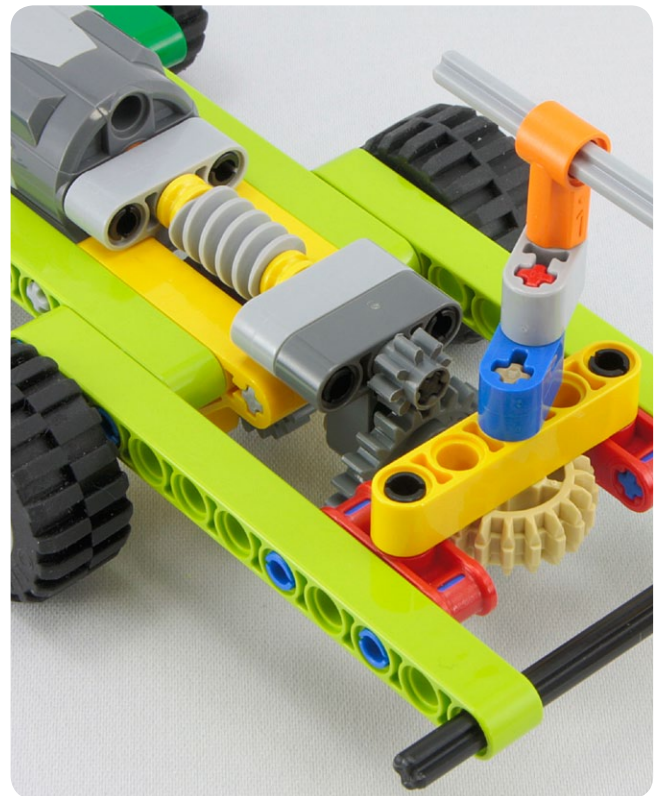
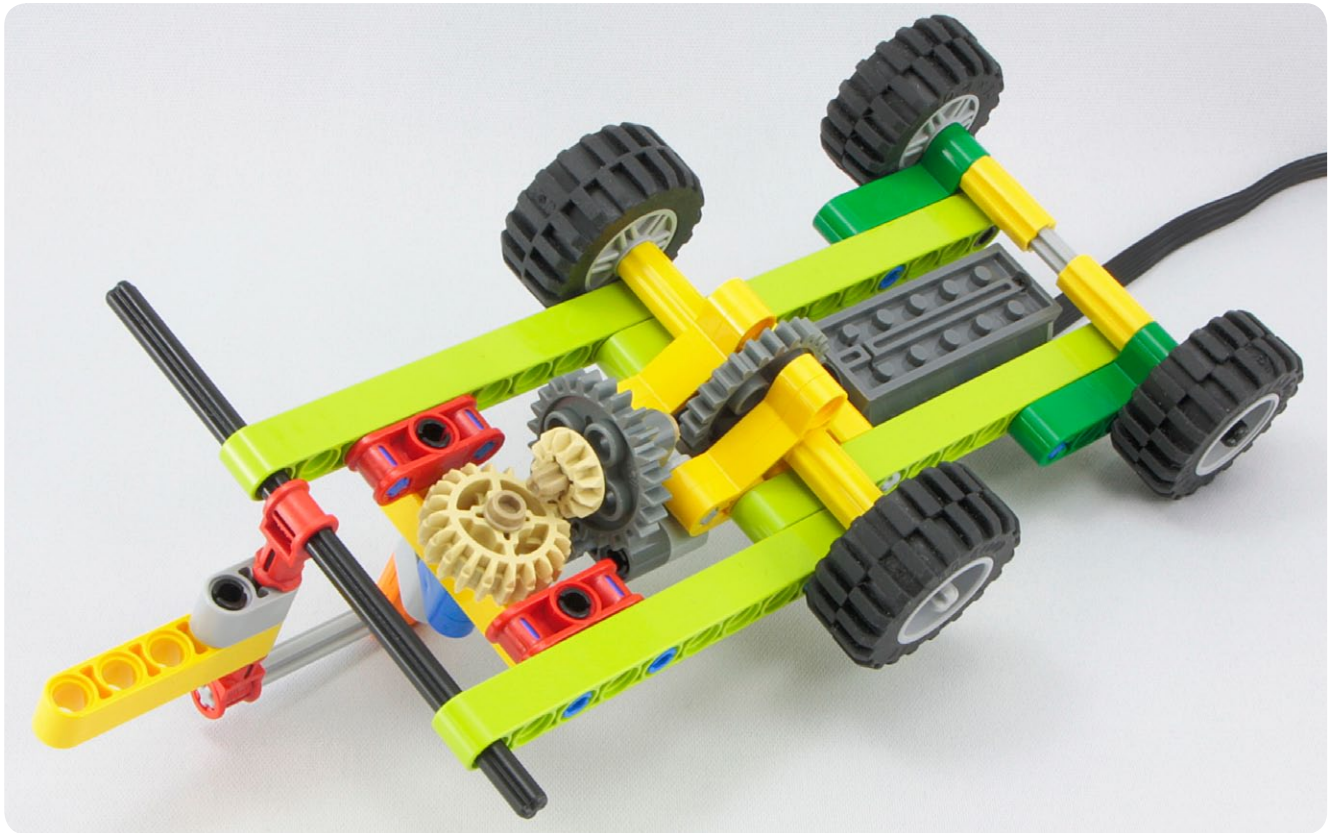


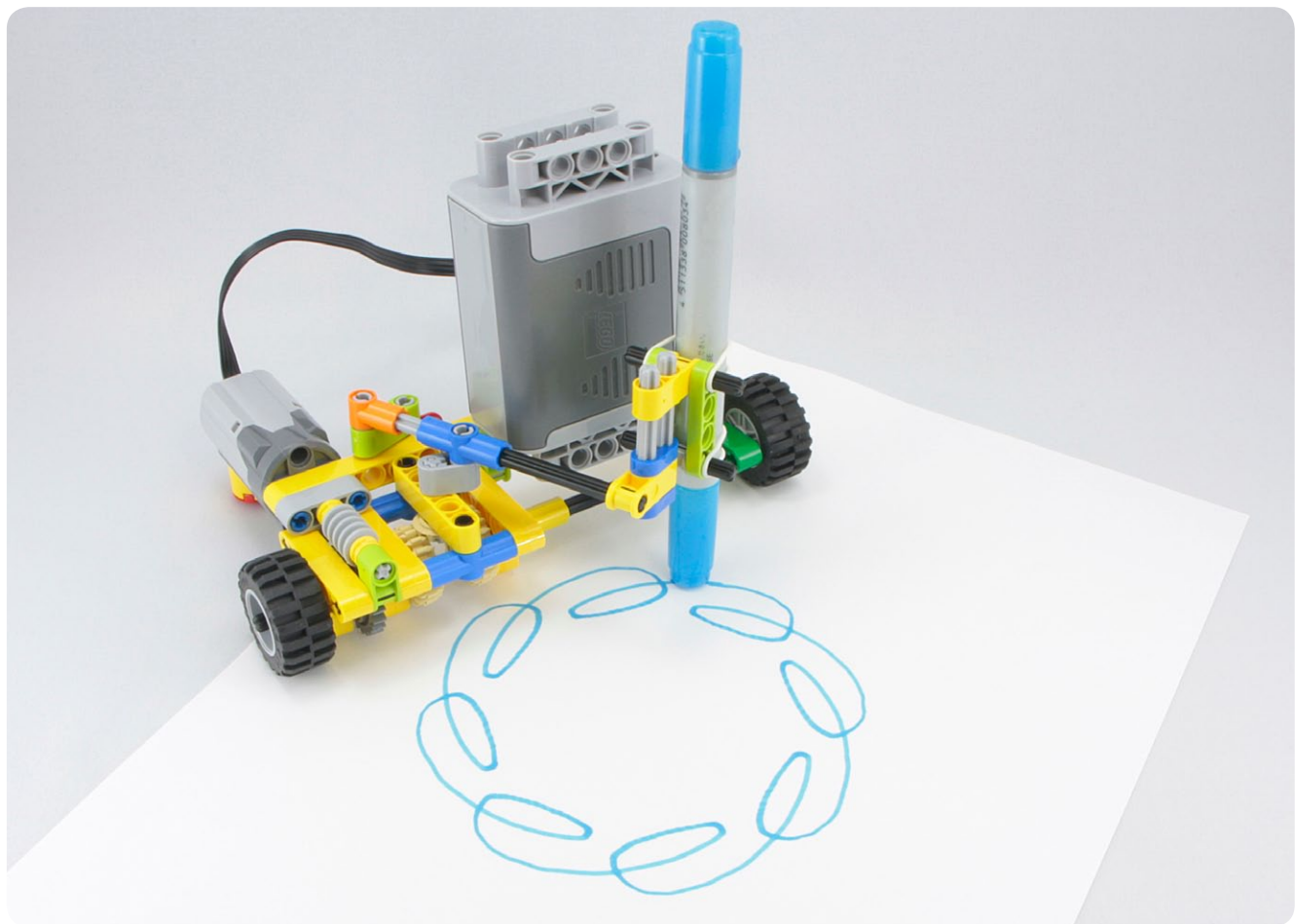
#262

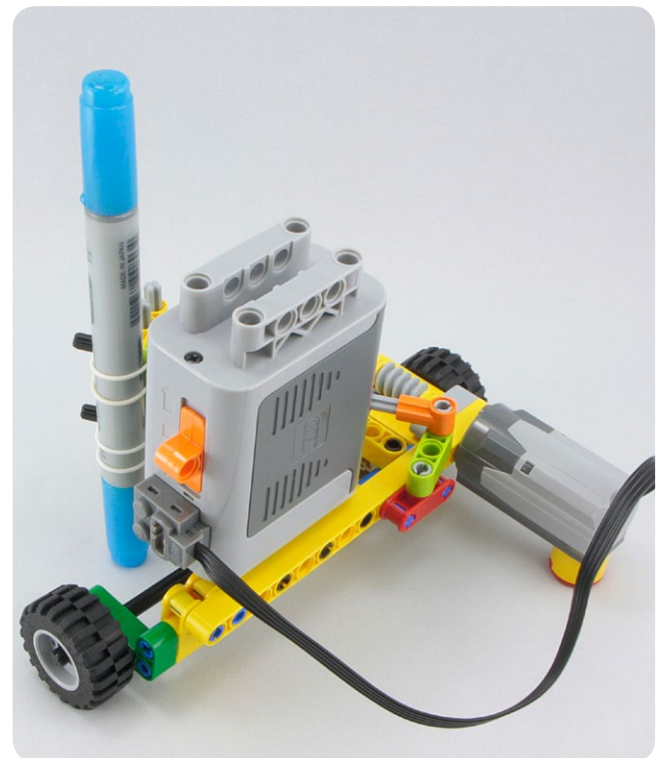
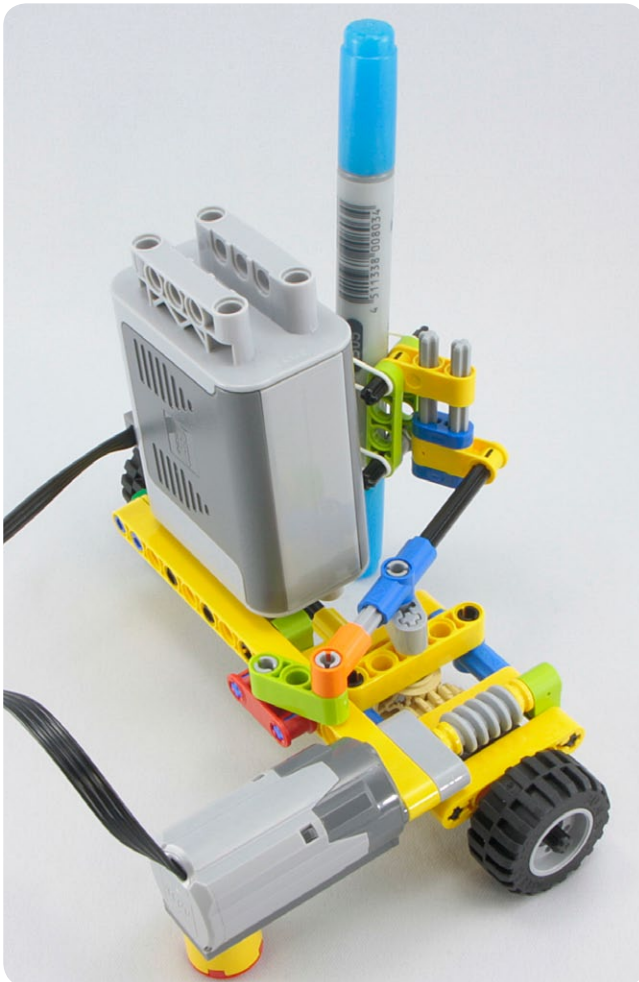
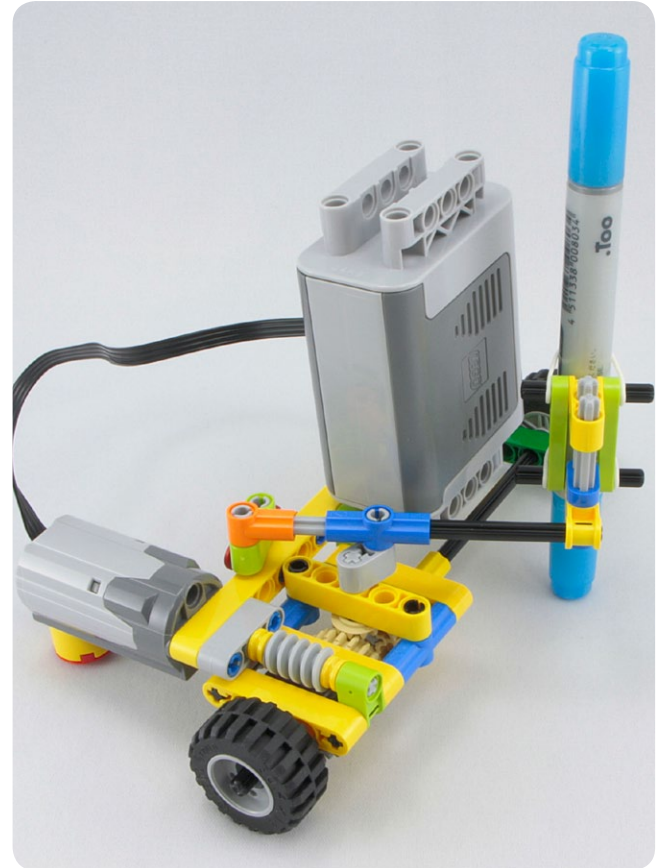


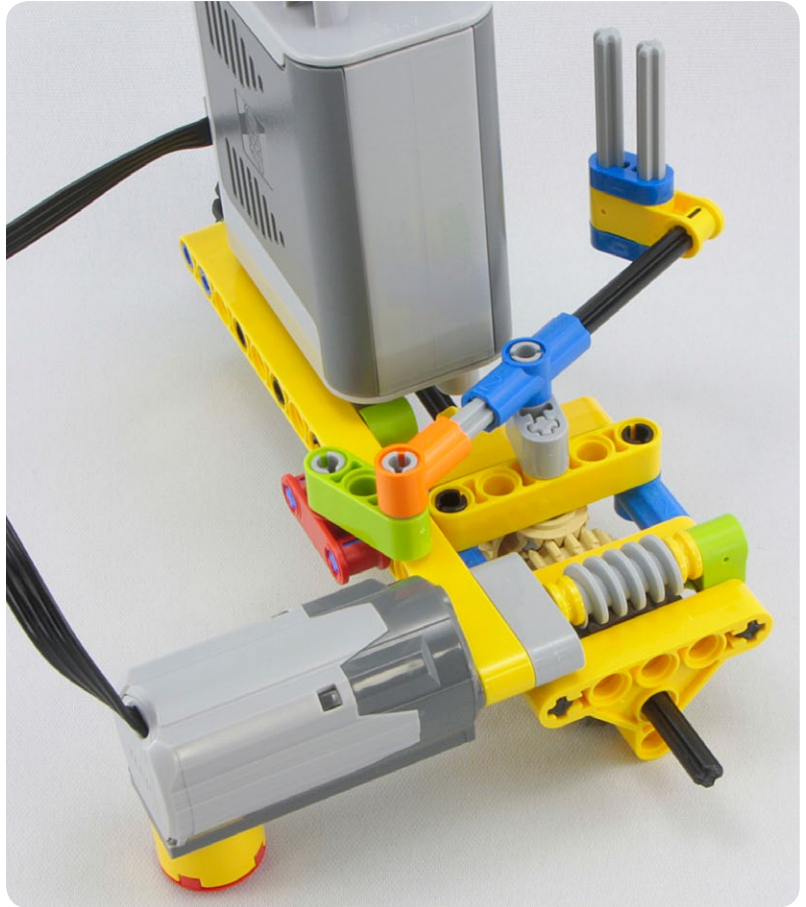


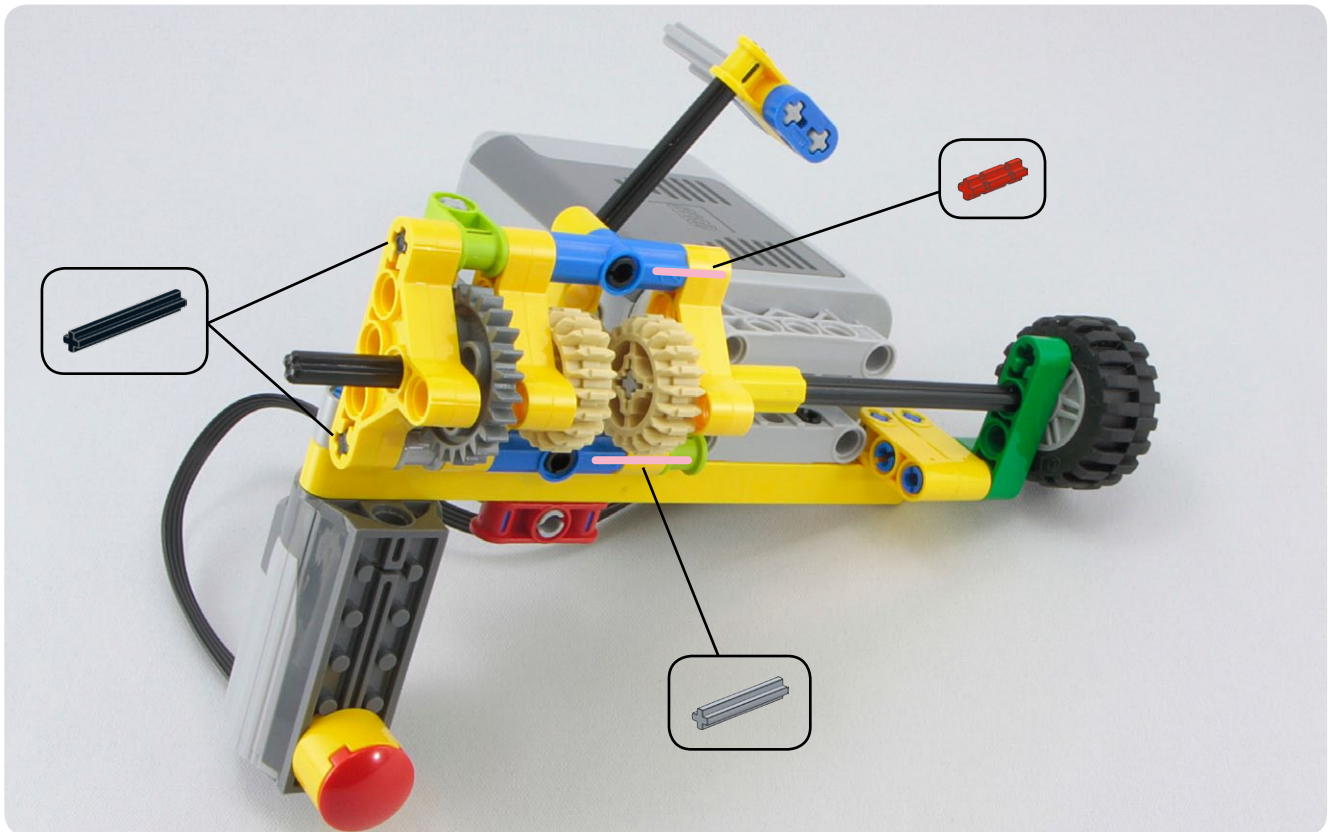
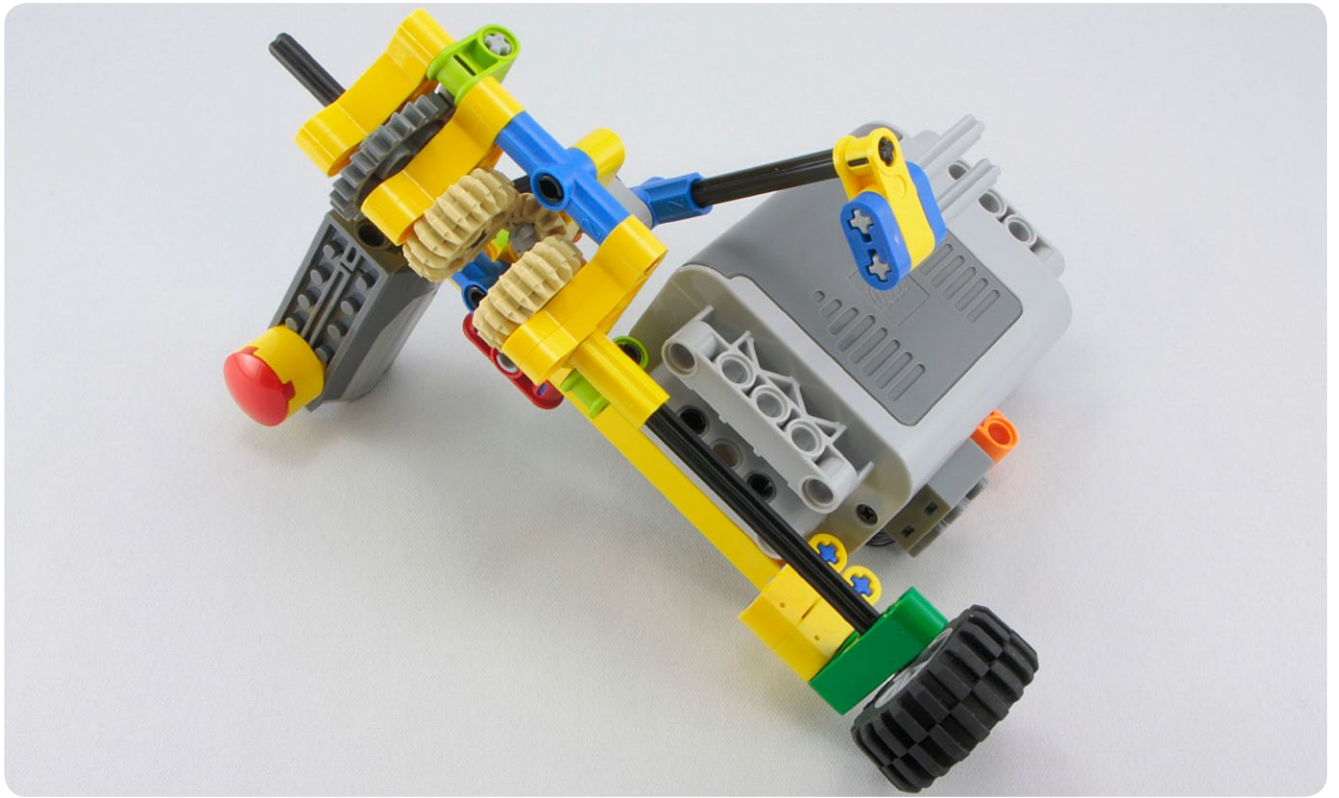




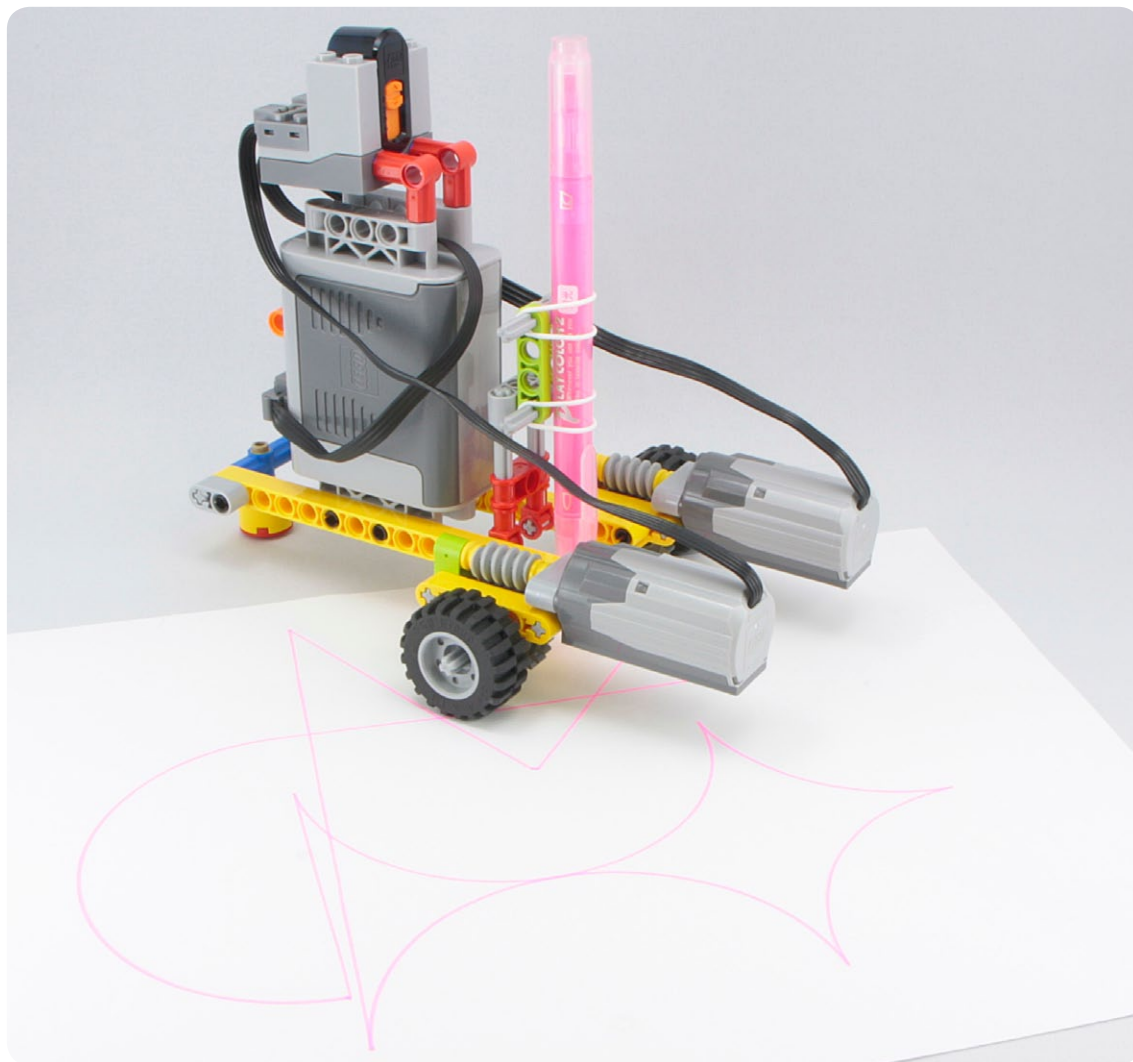
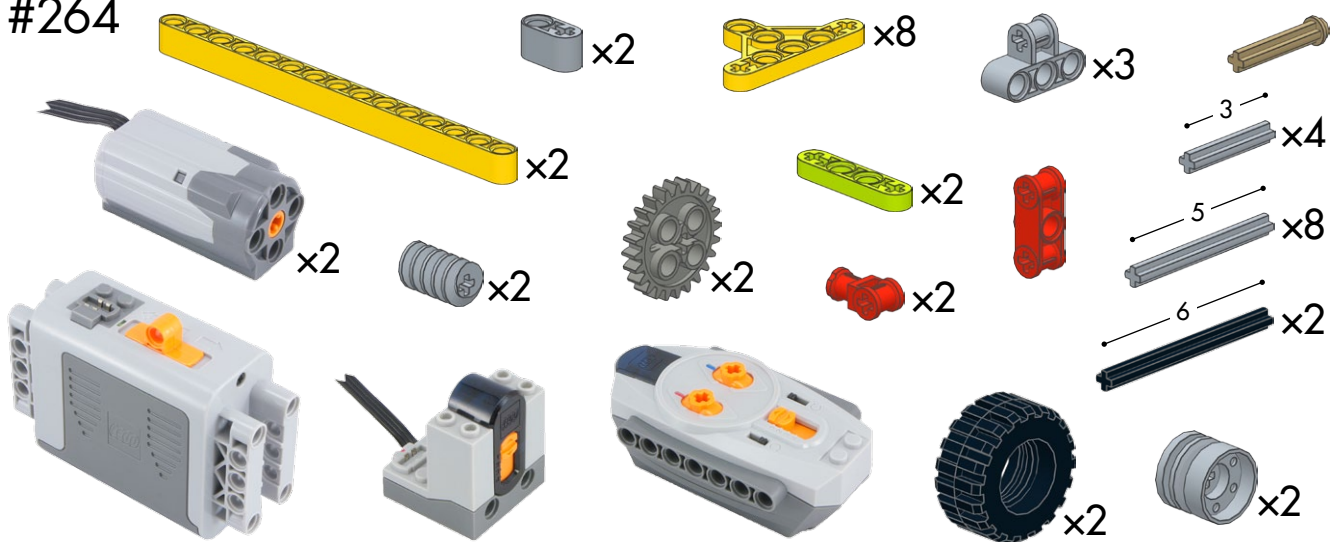
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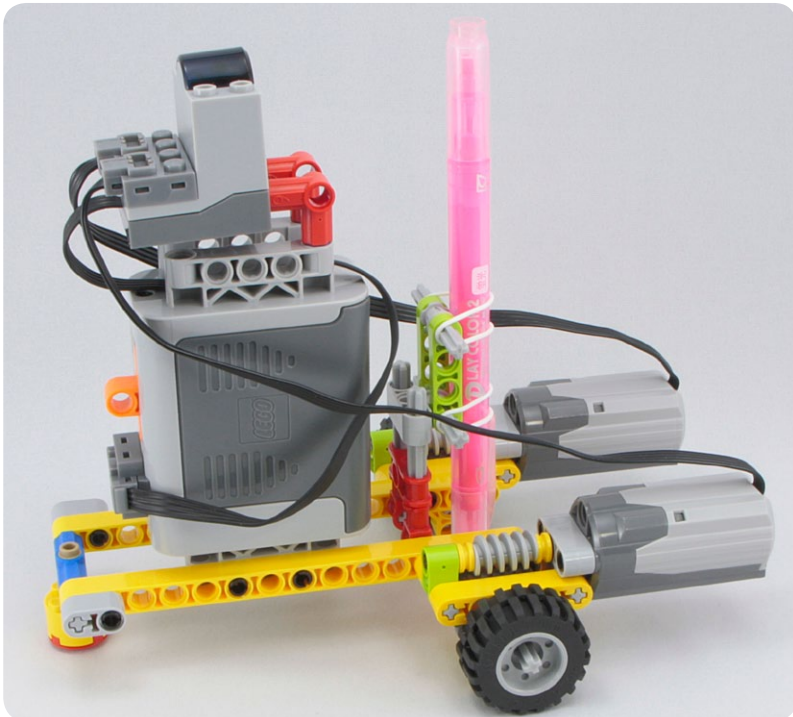
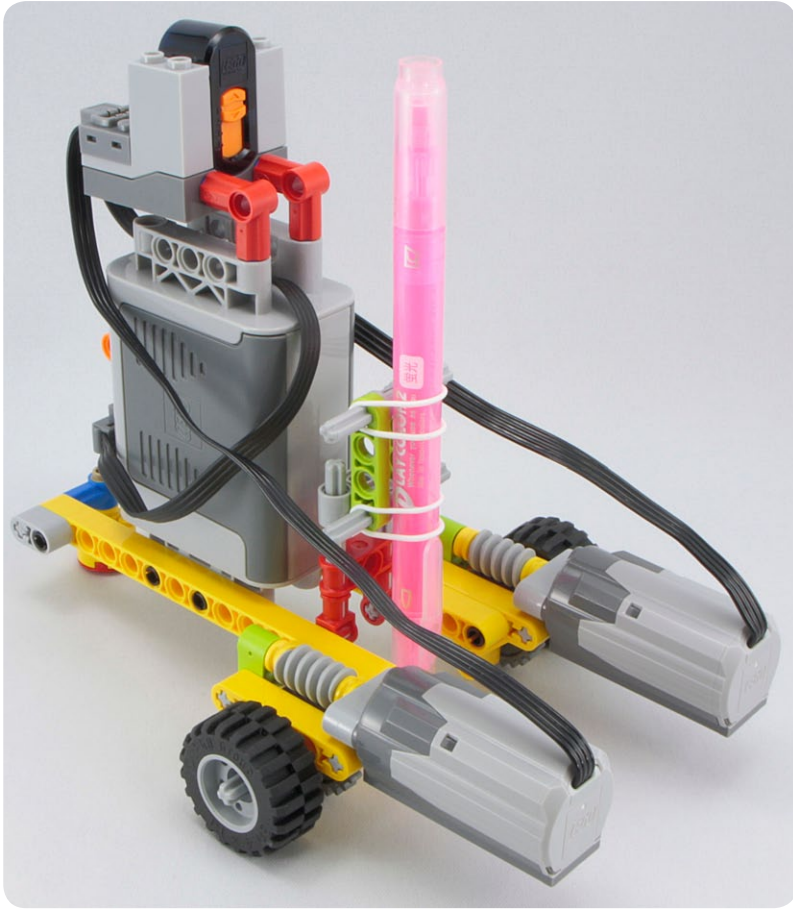


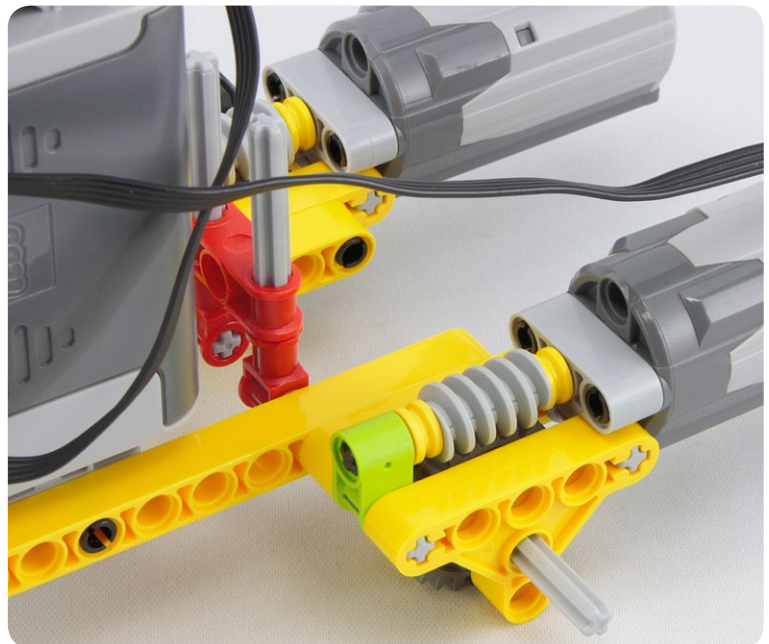
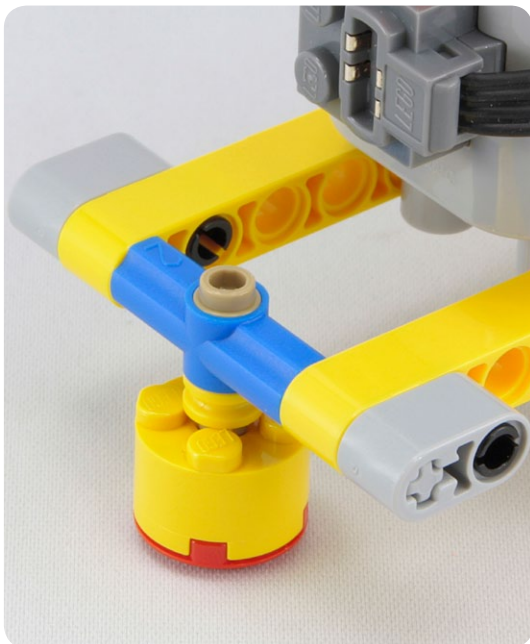
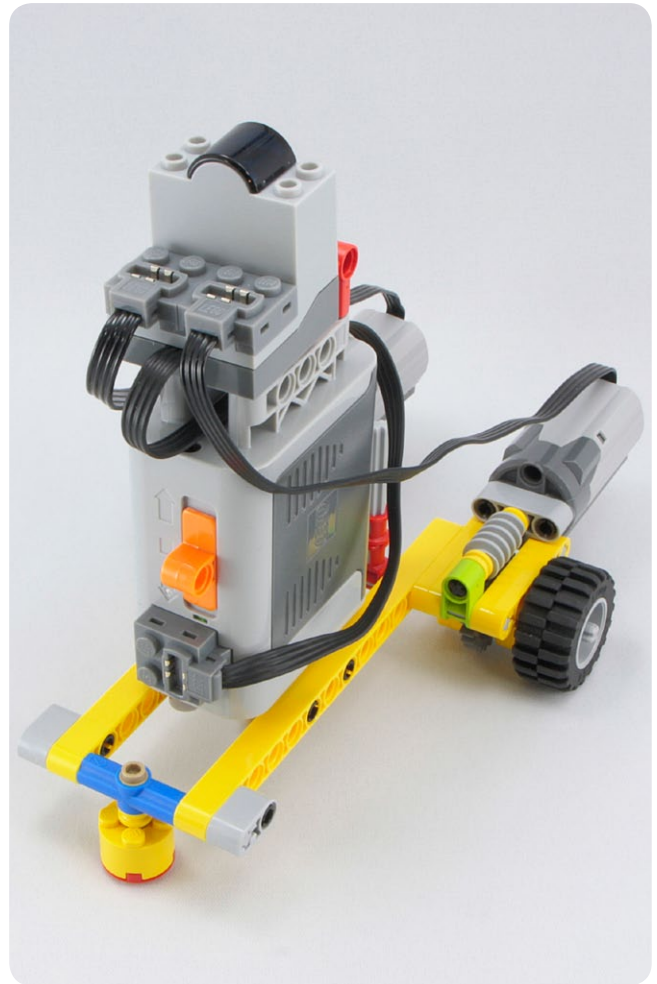
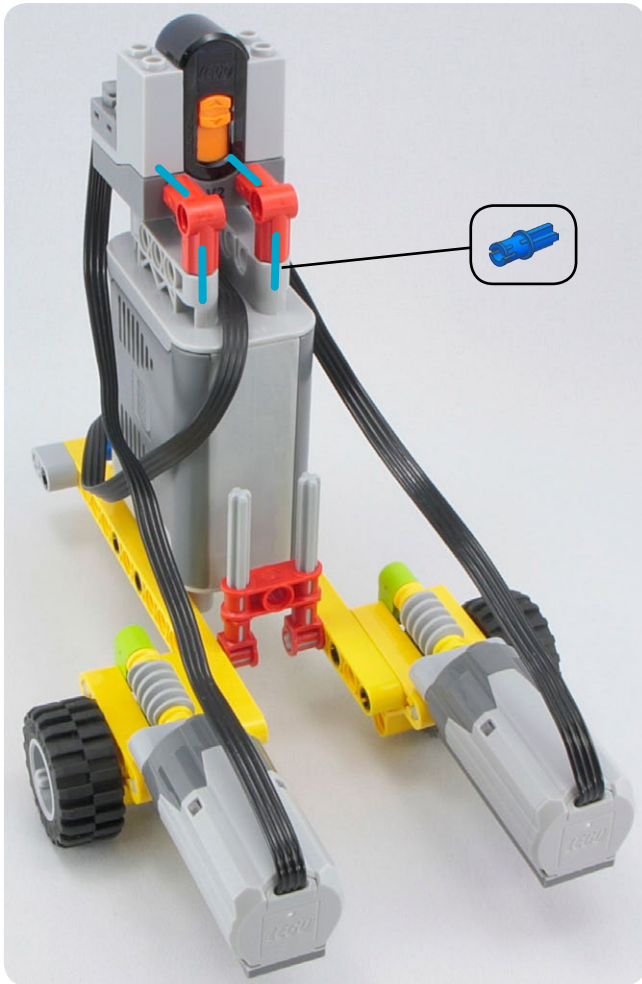


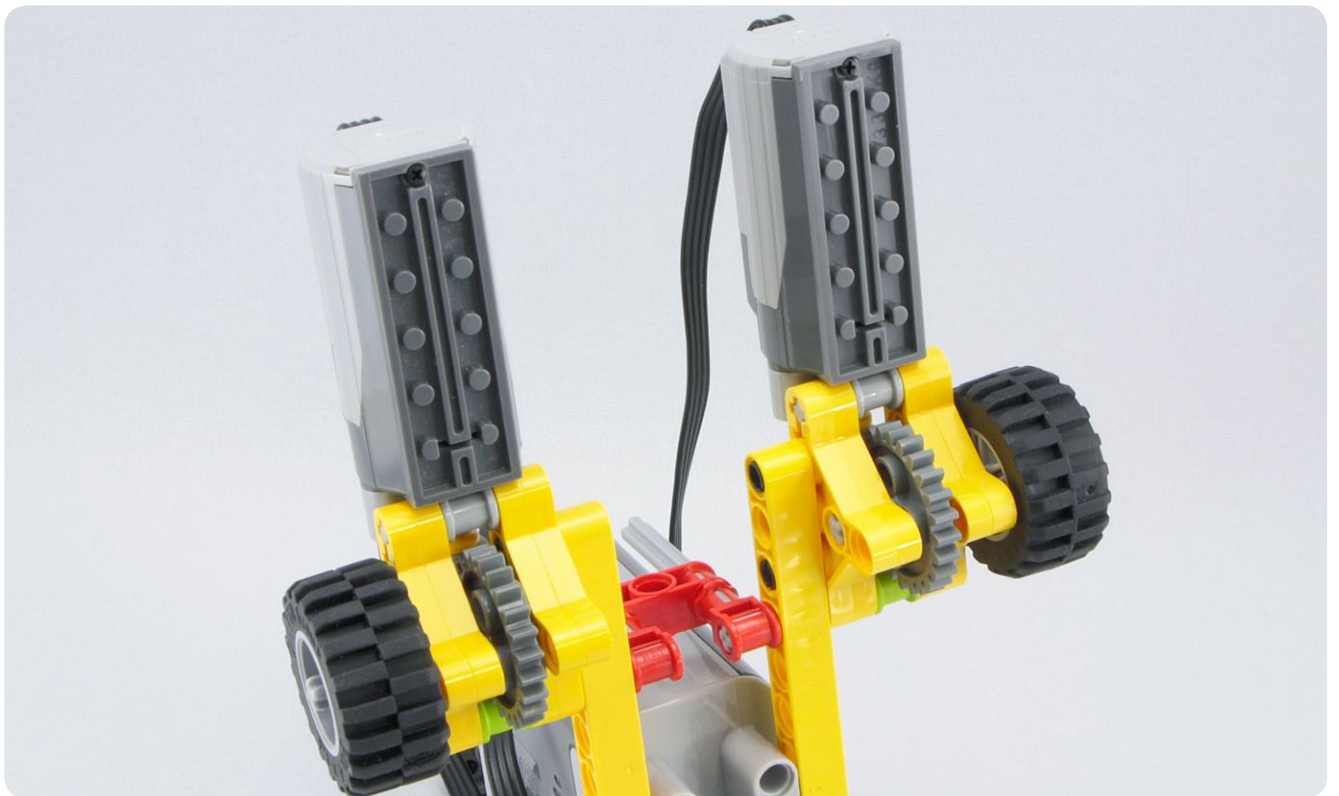
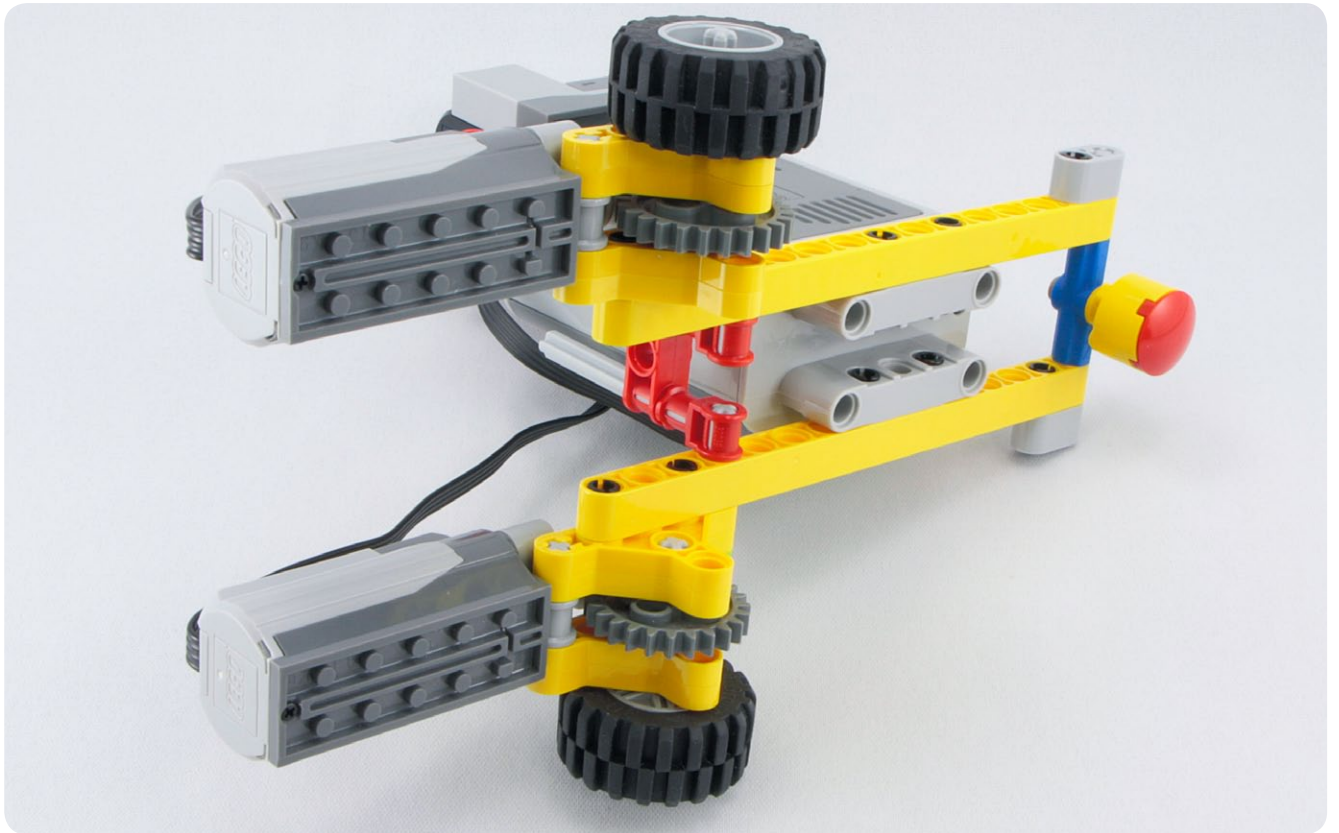


#264

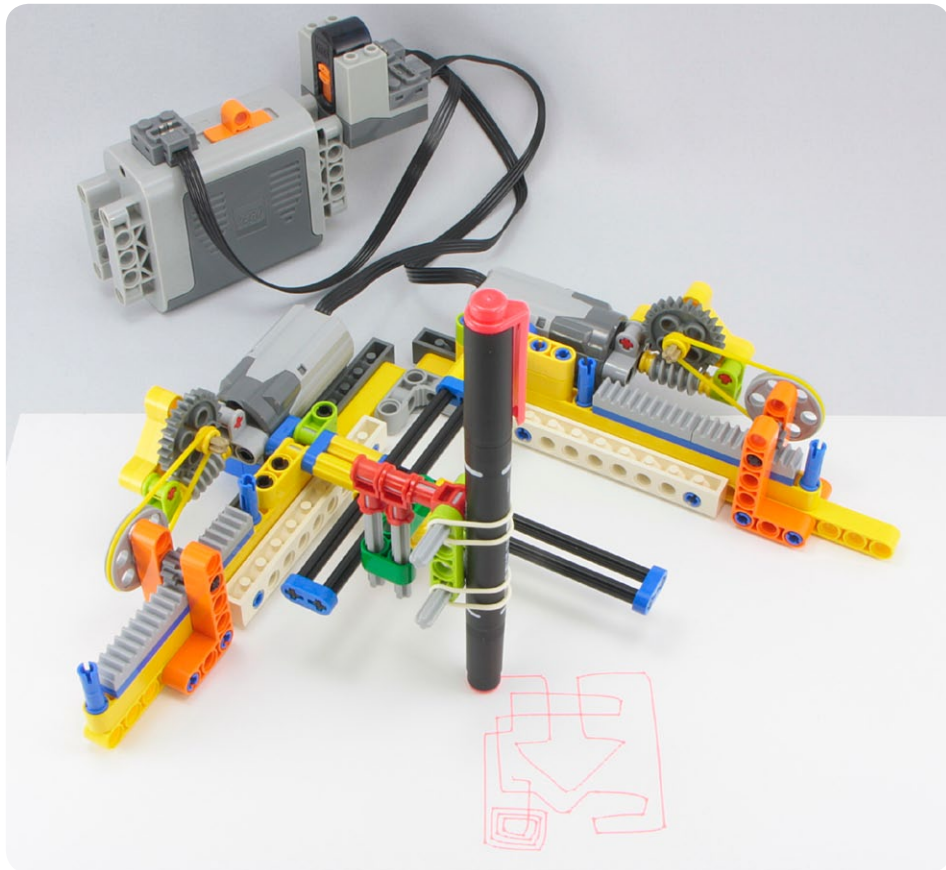
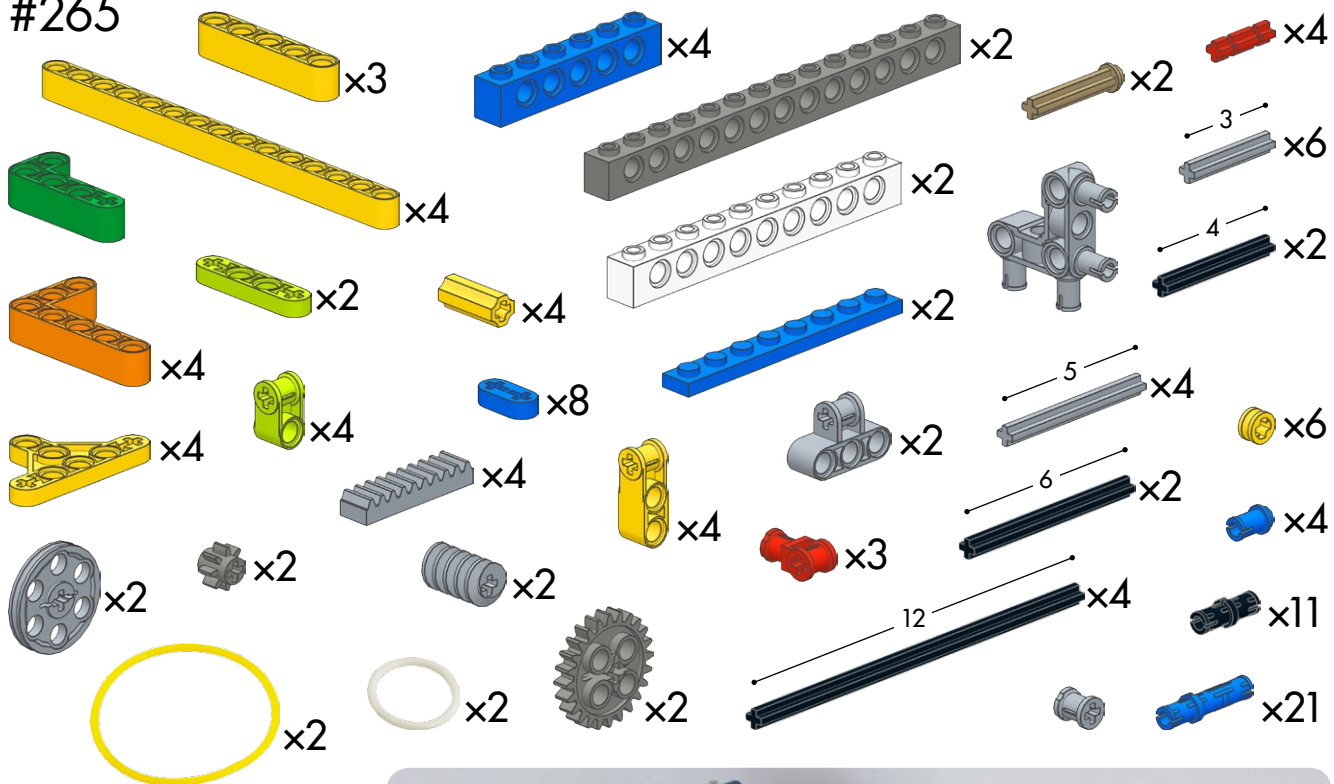


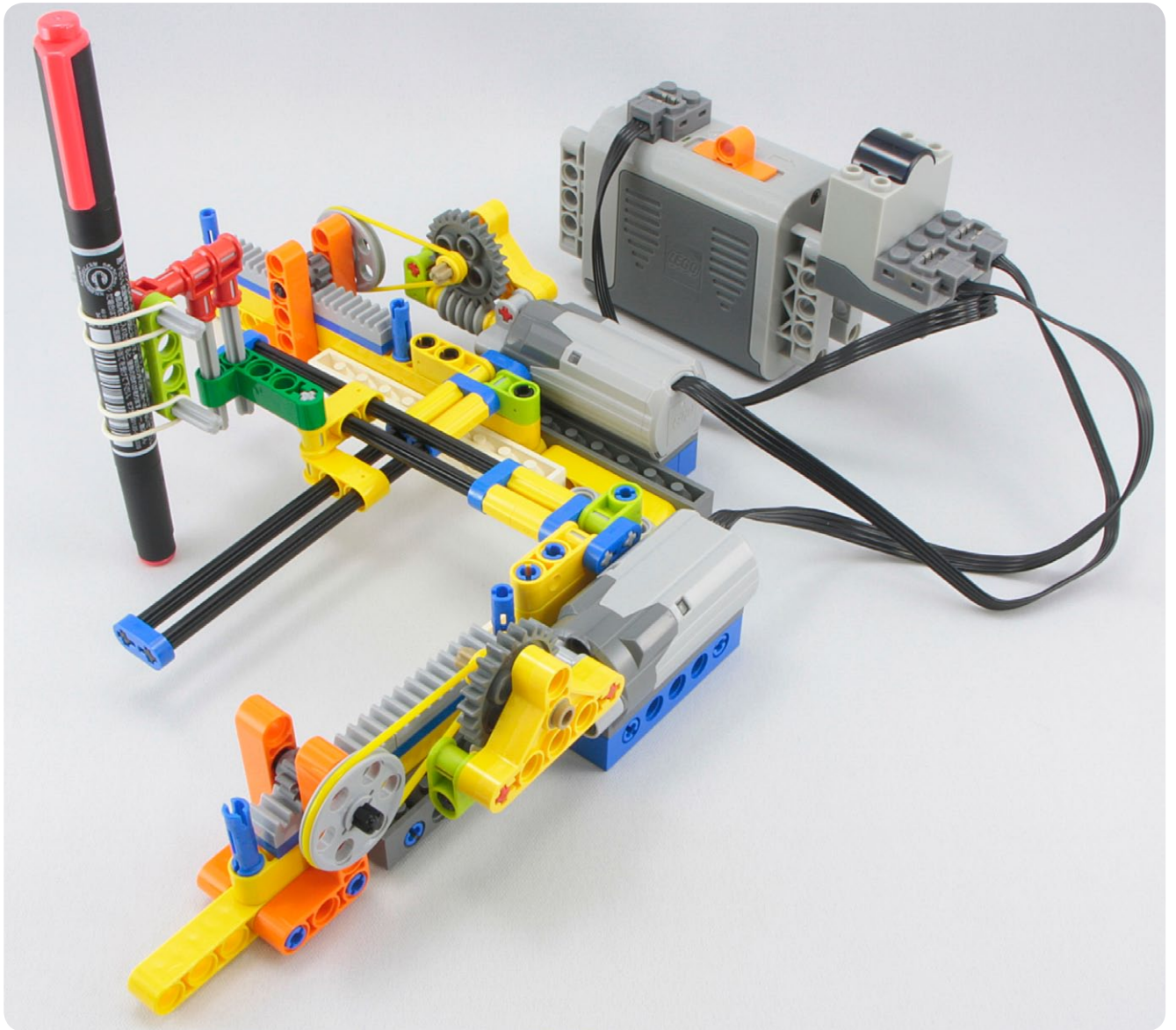


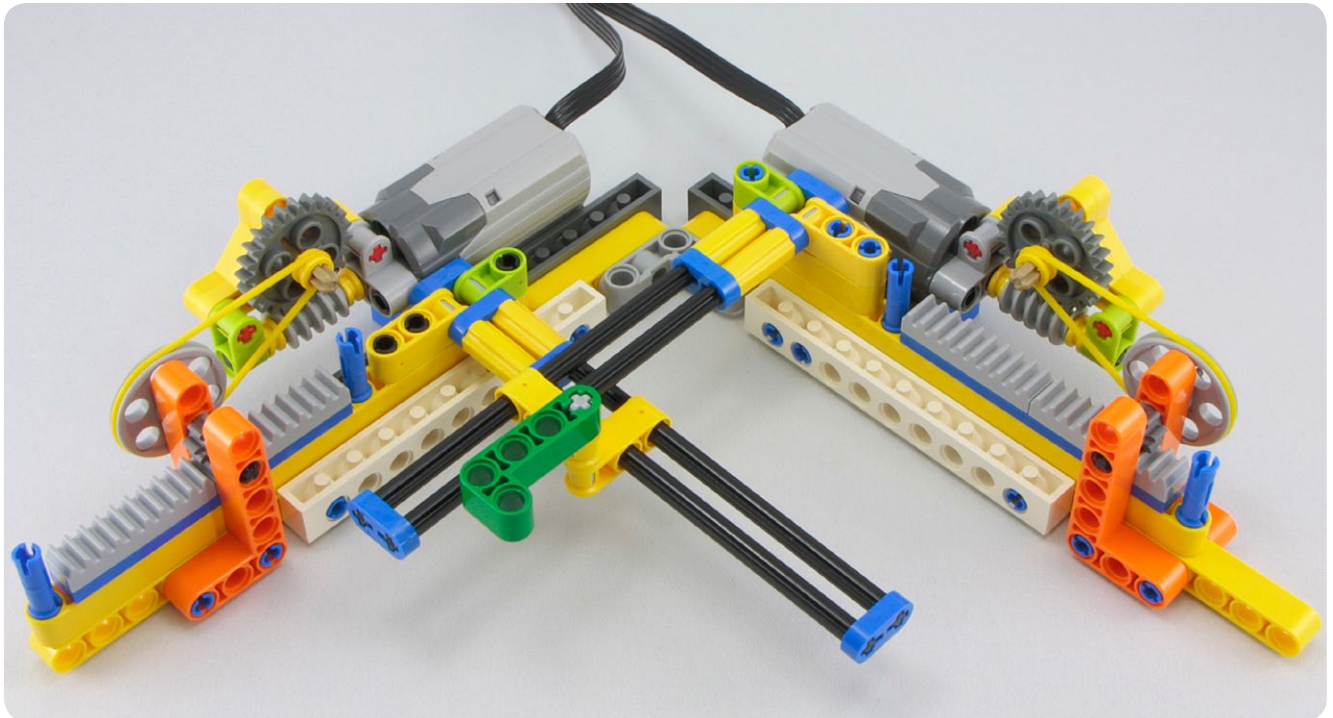
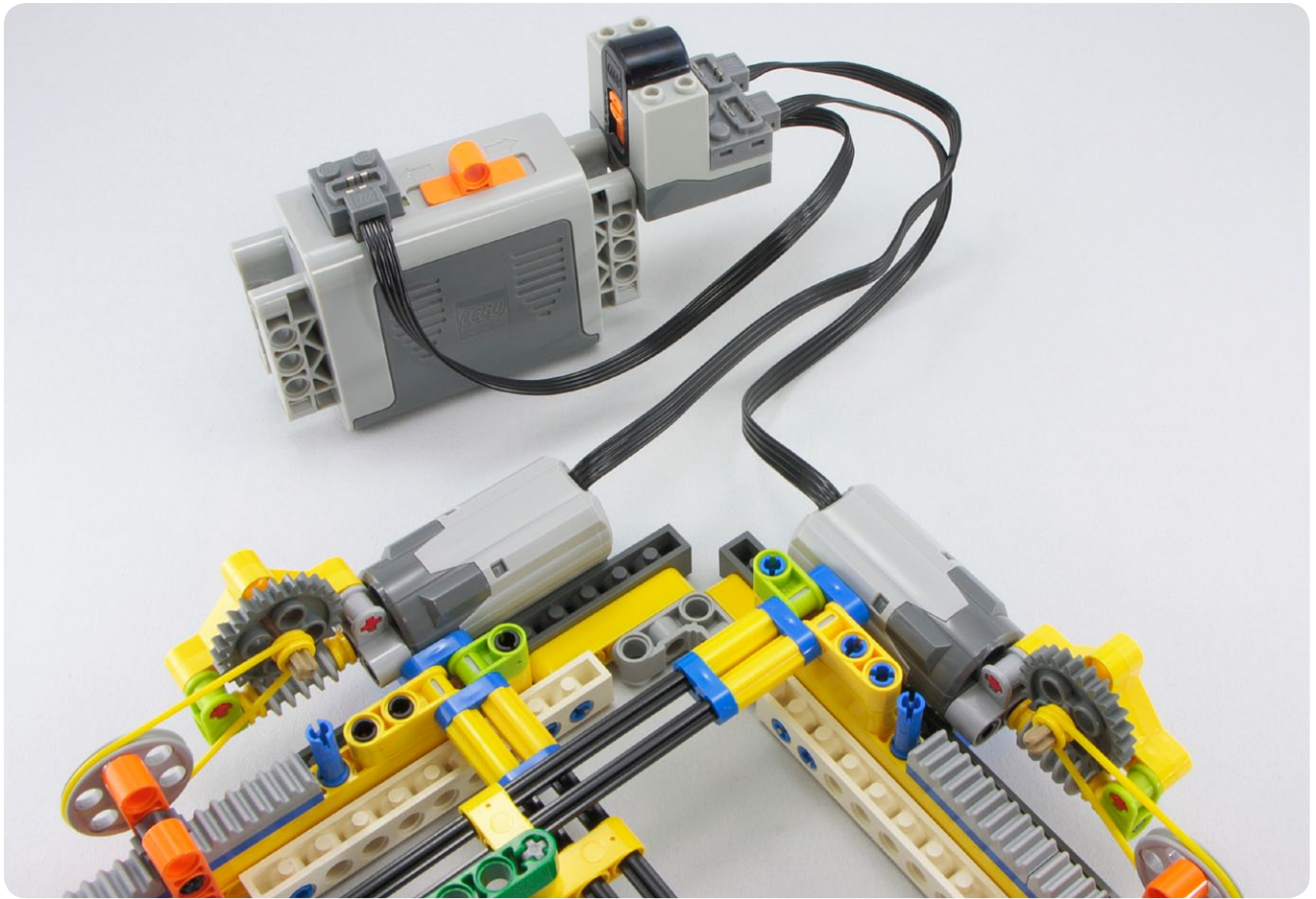


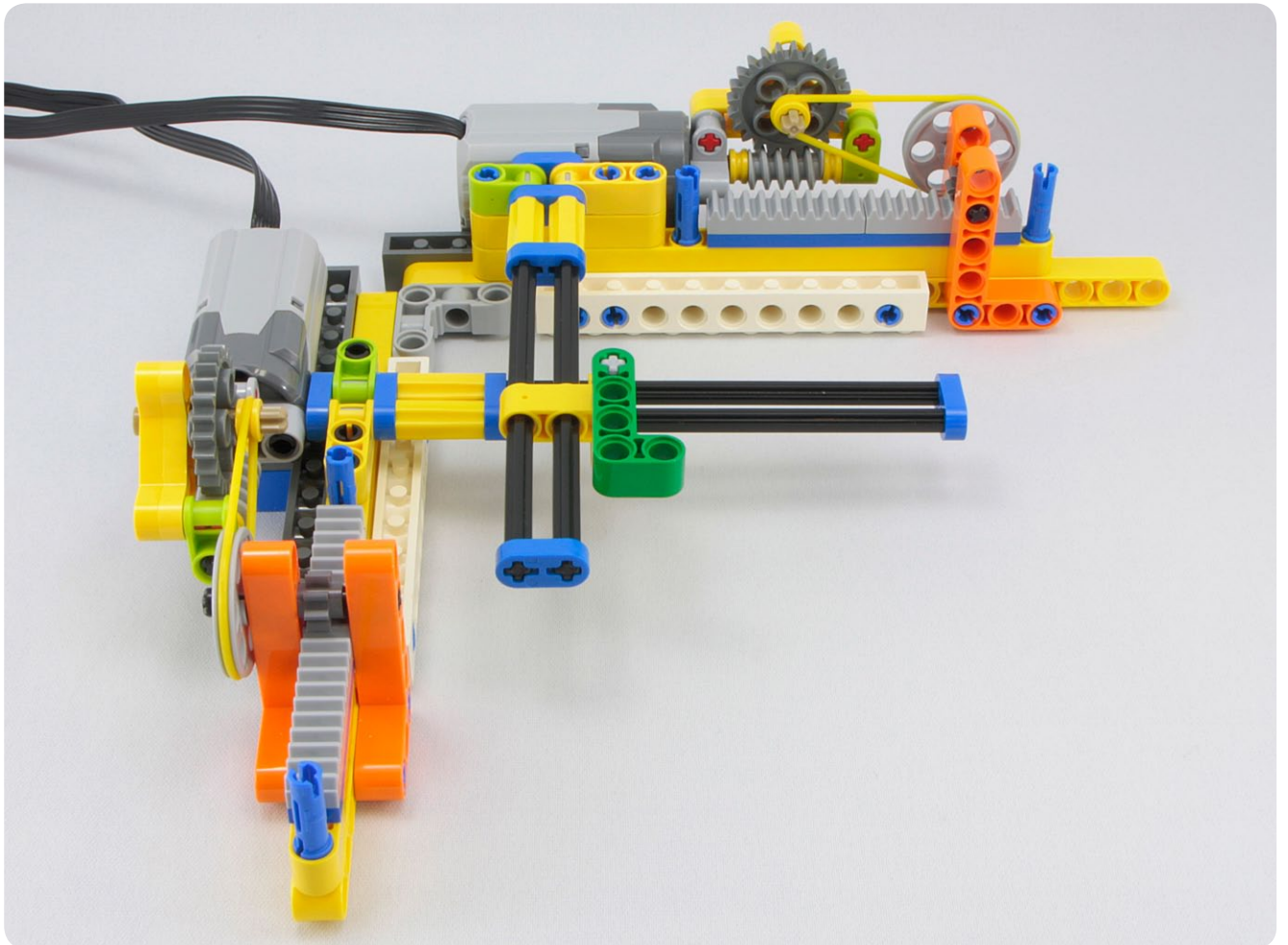
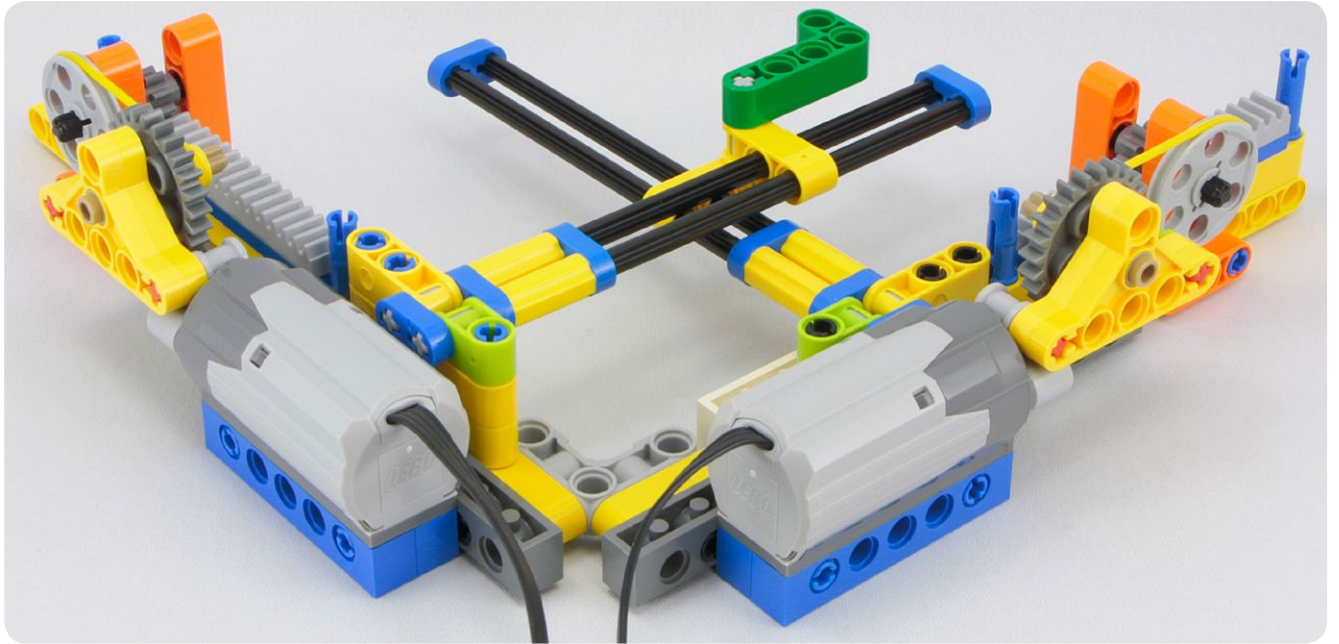


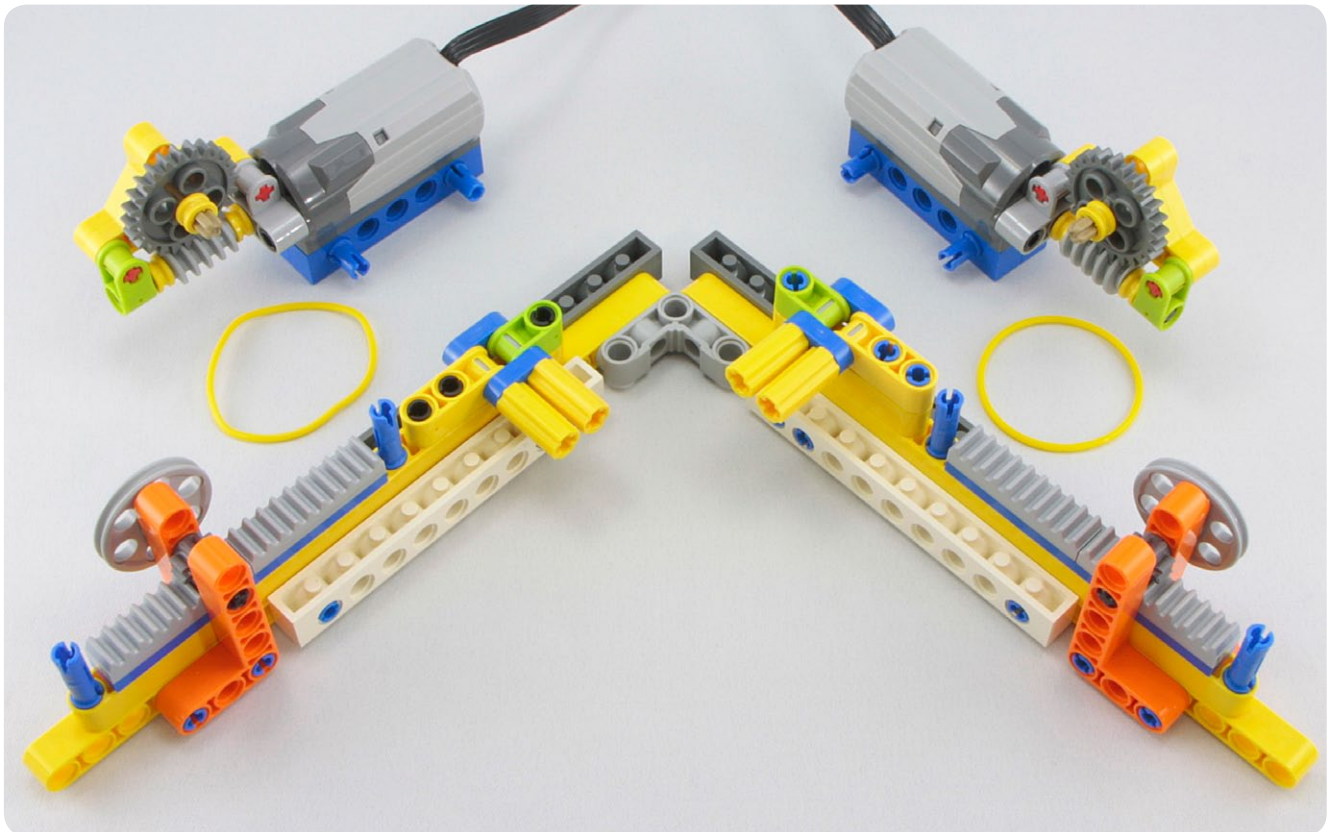
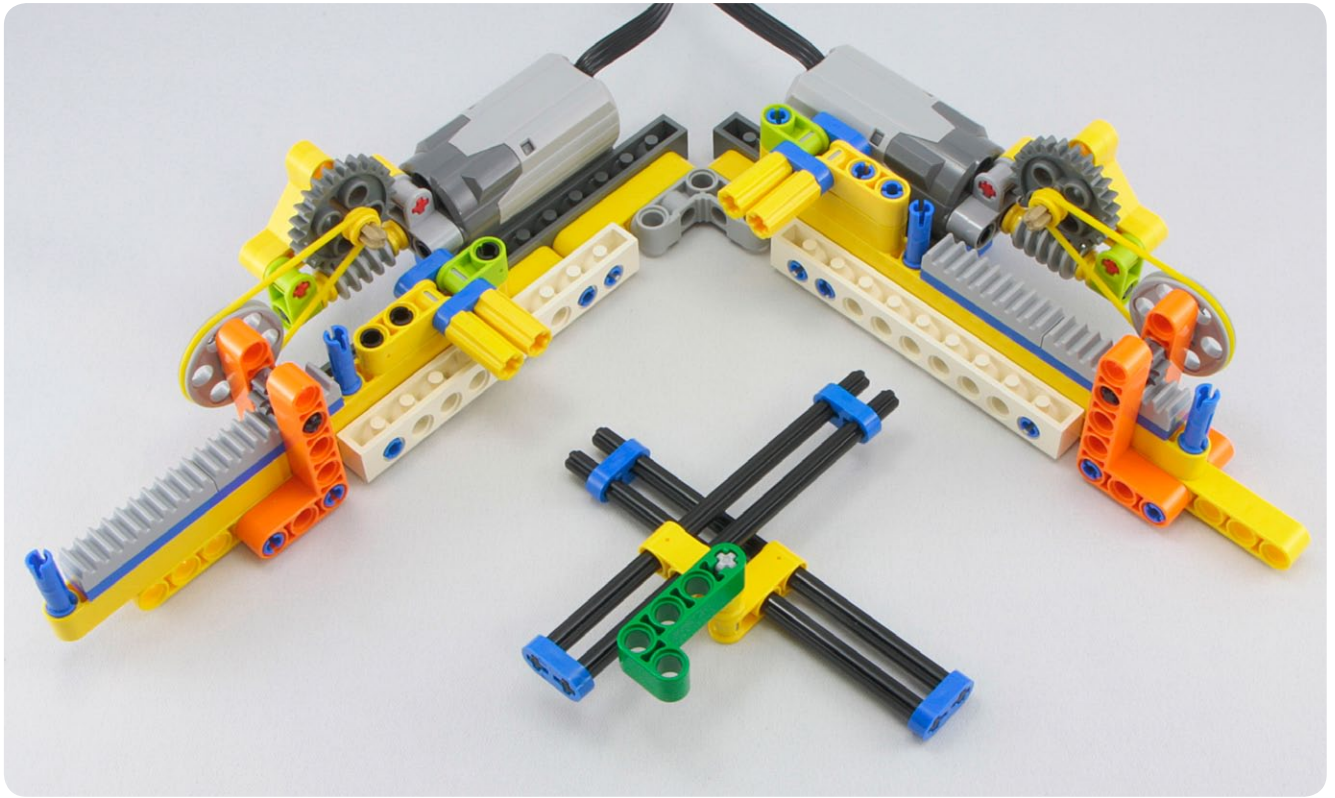
#265

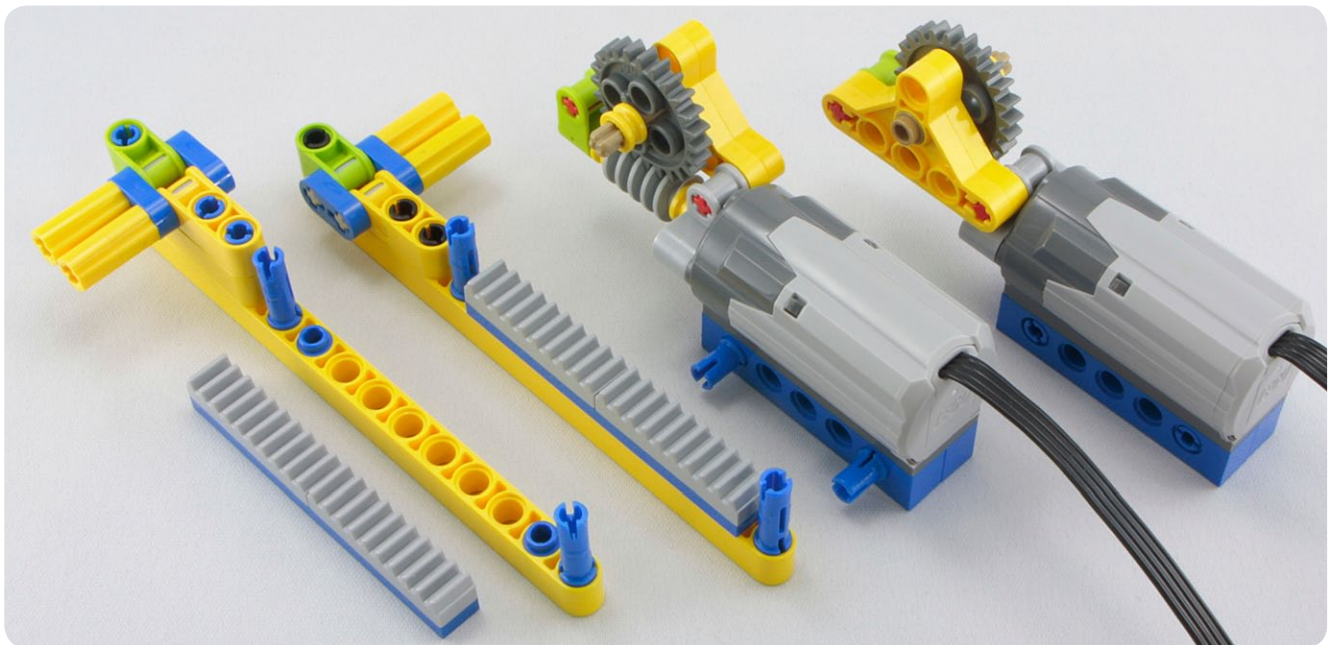
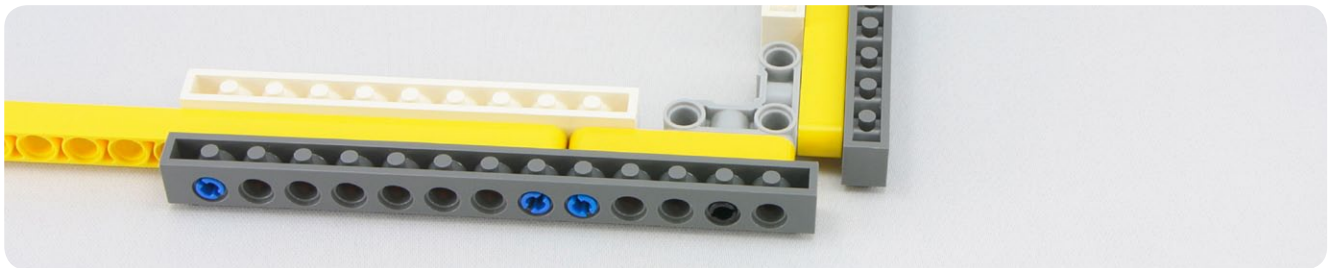
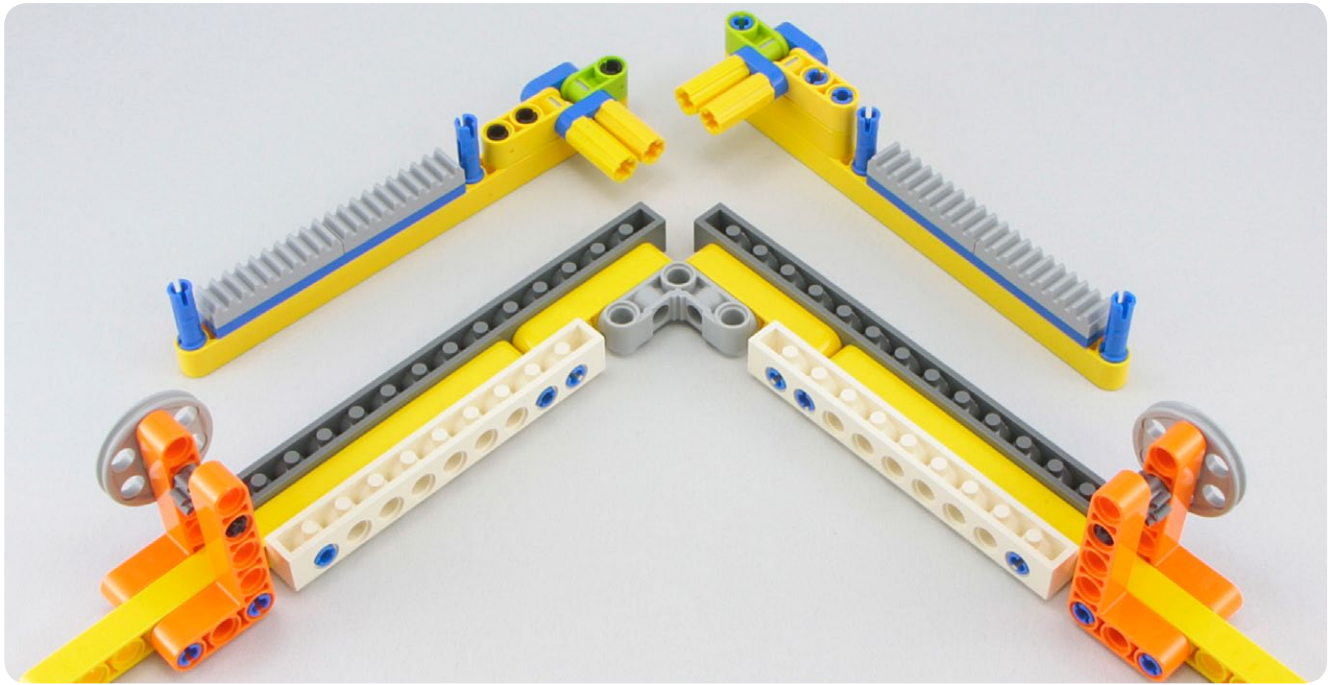


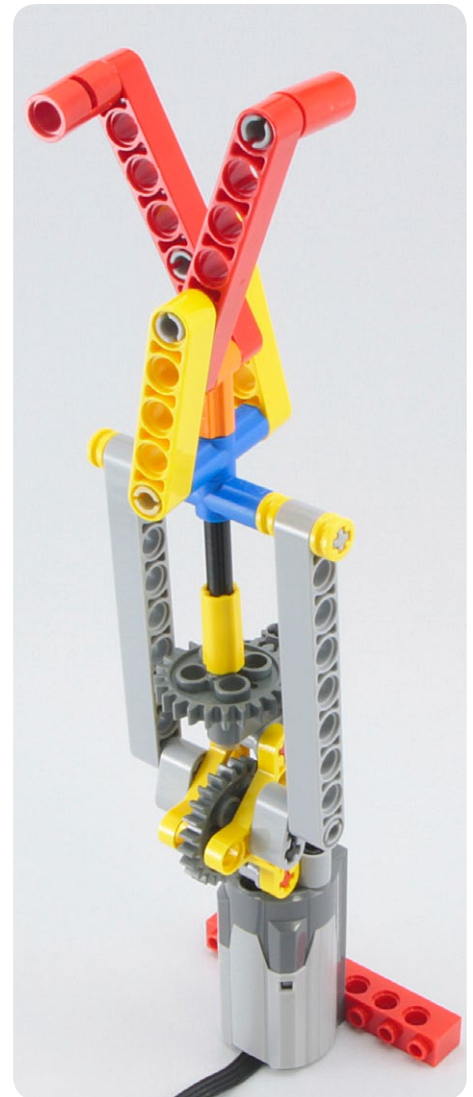


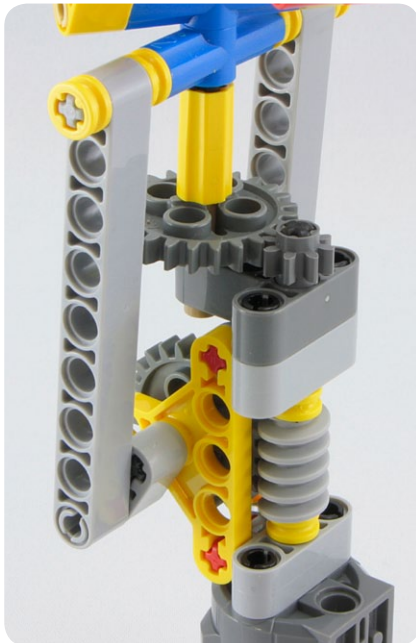
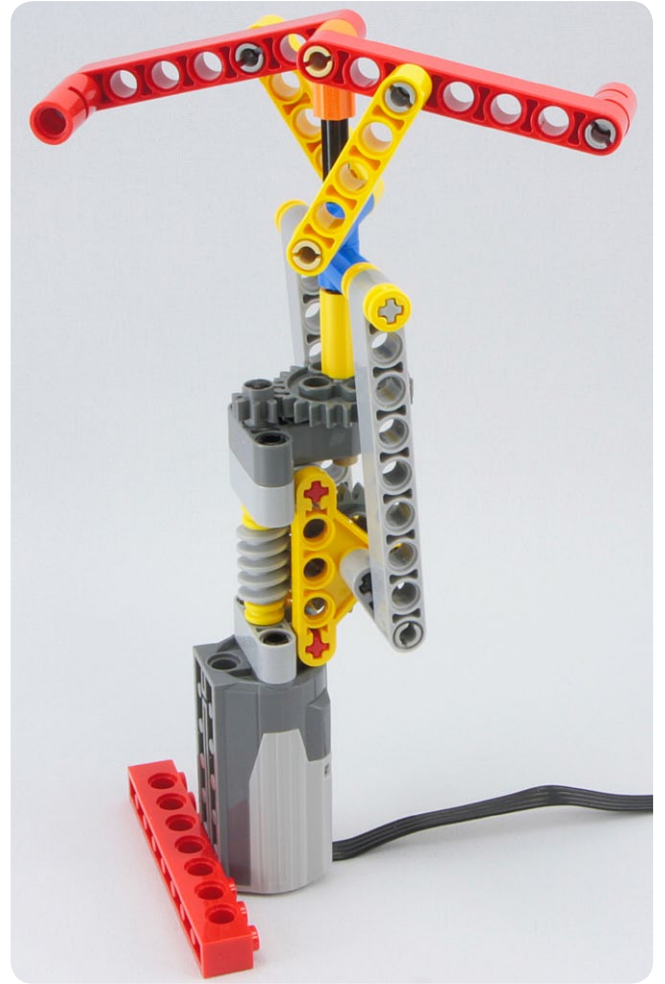


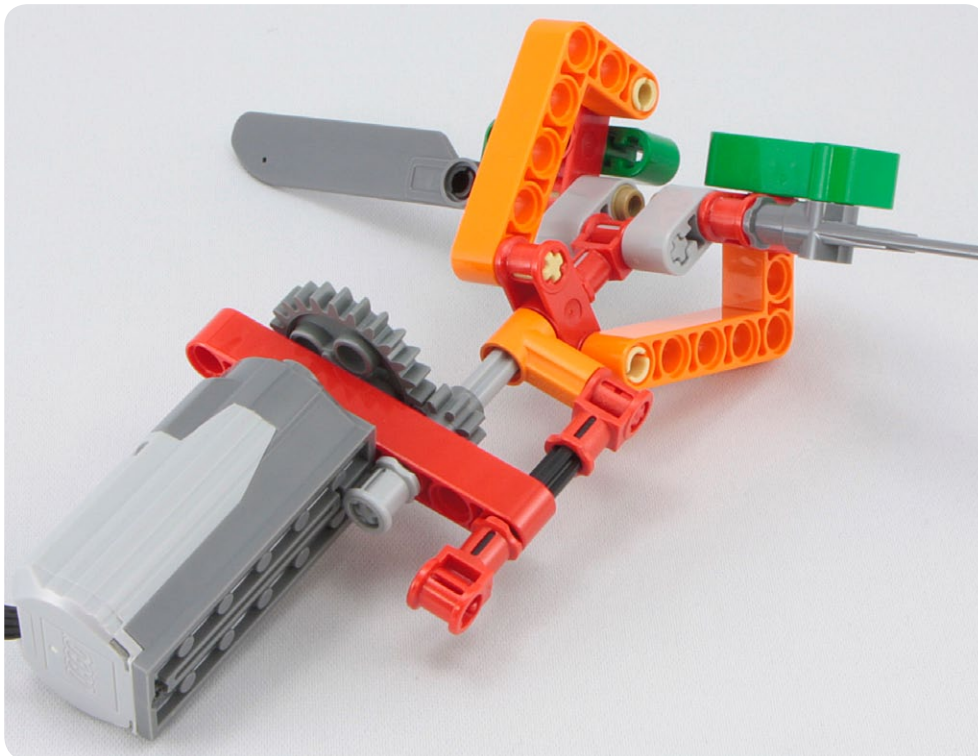
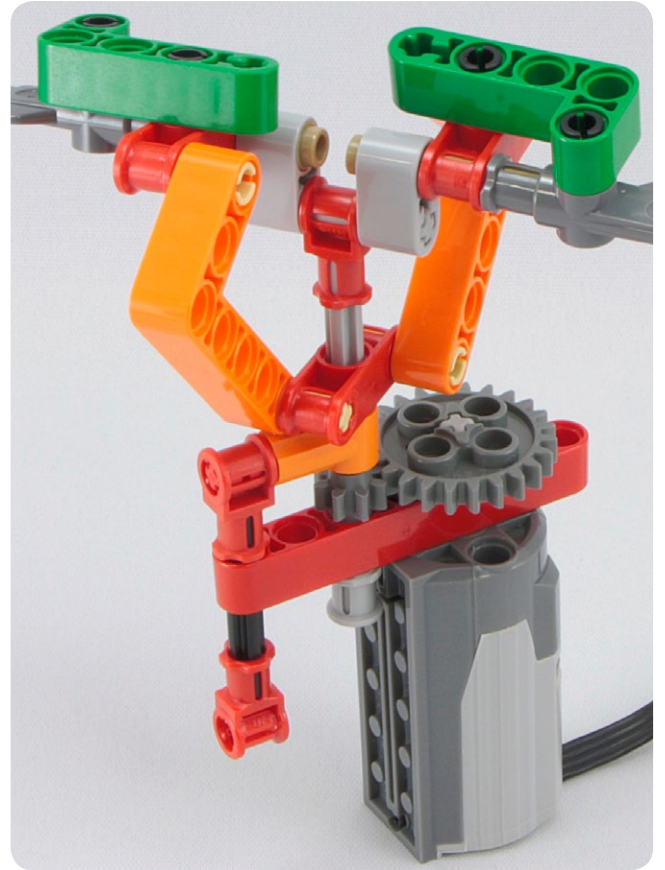
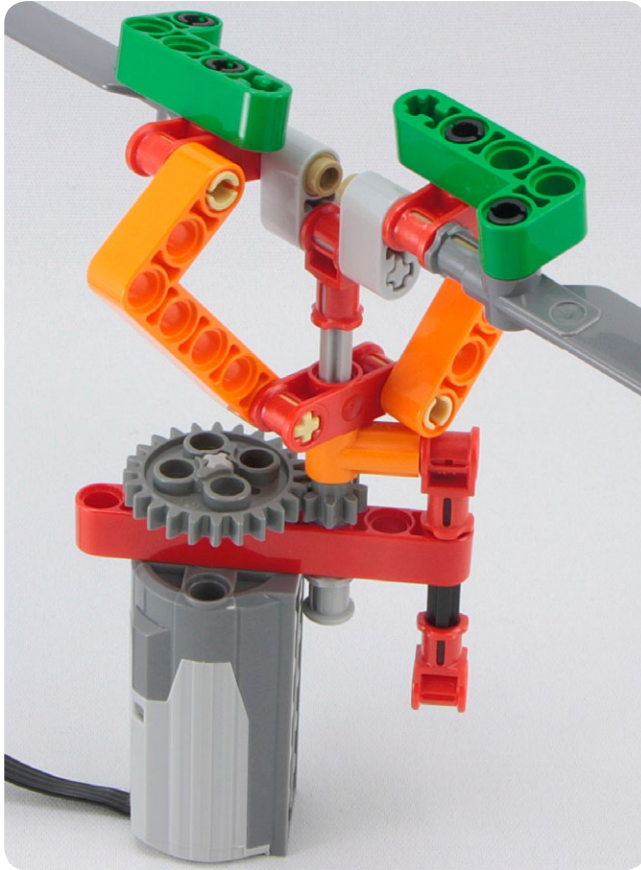




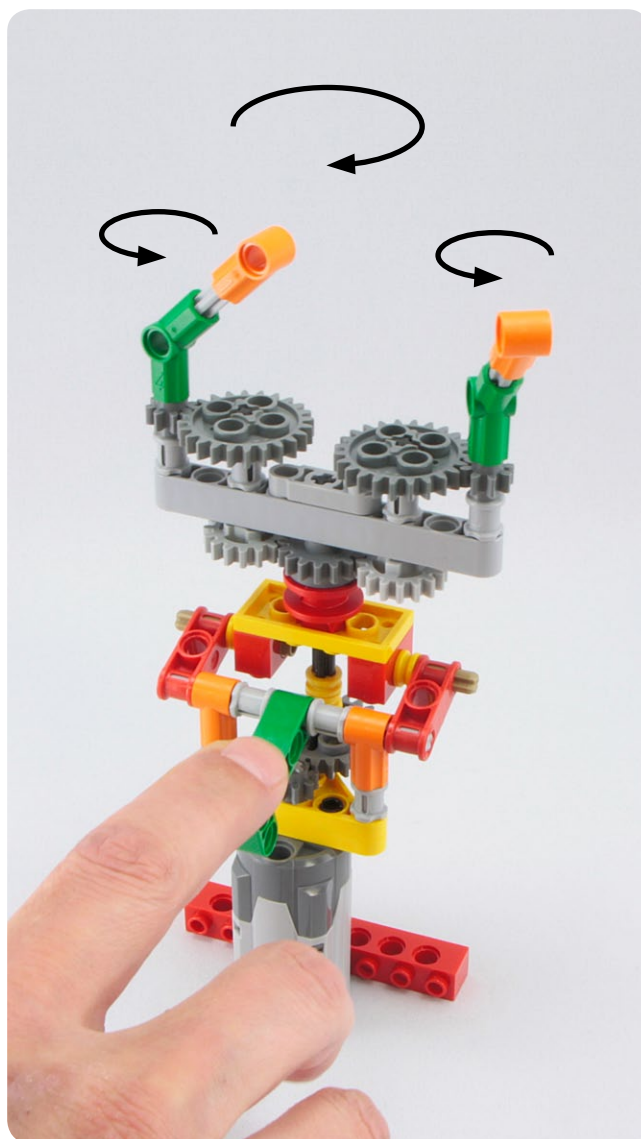
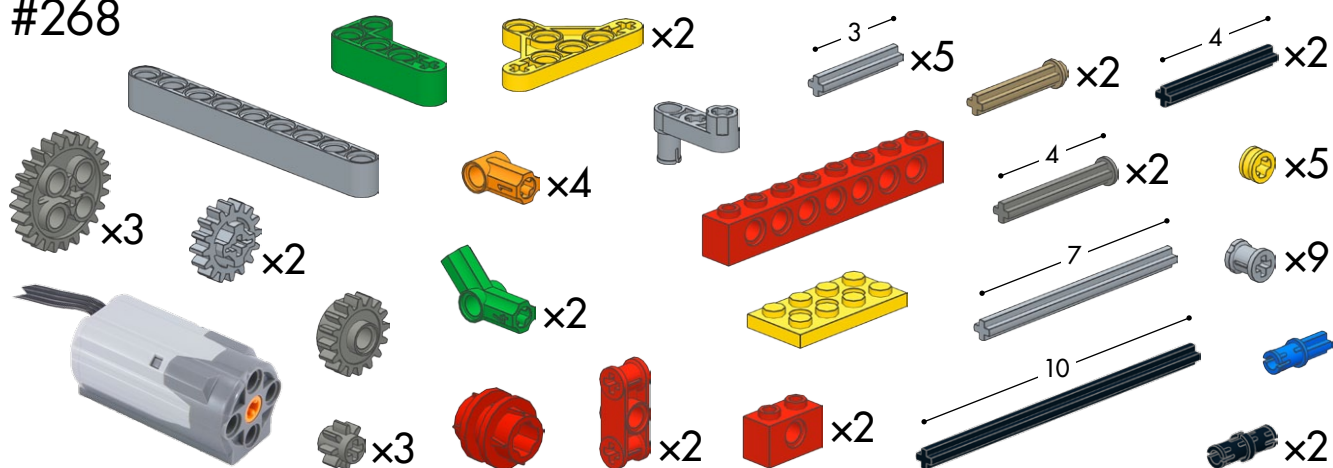


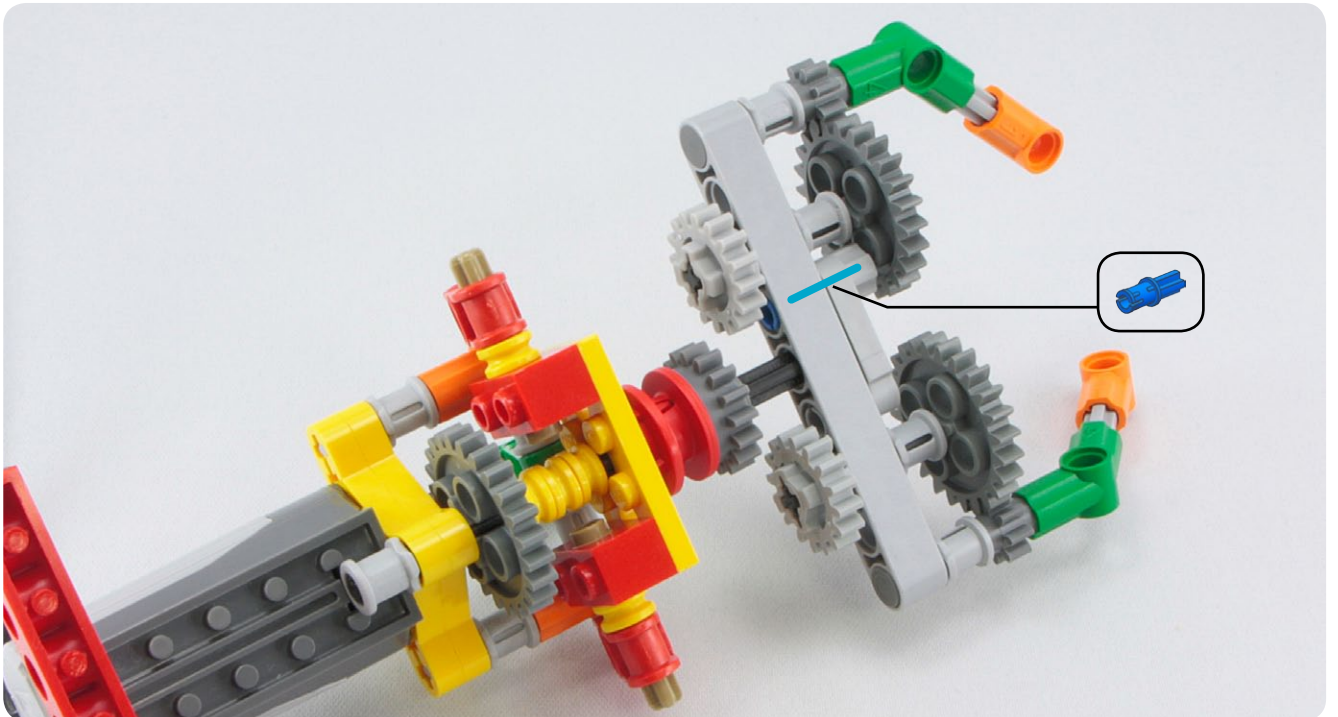
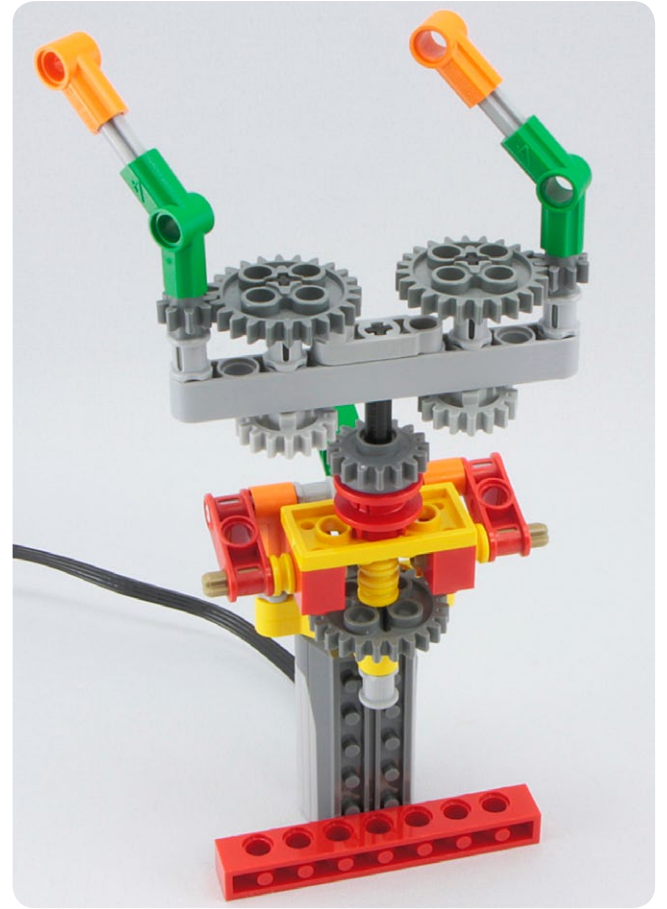
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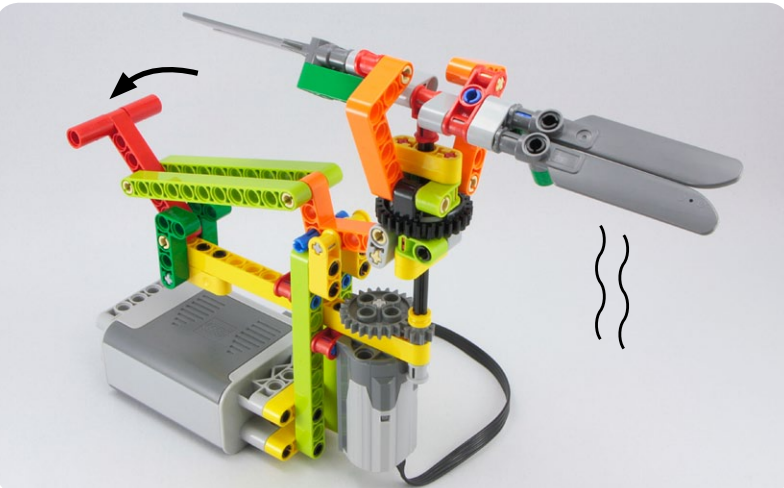
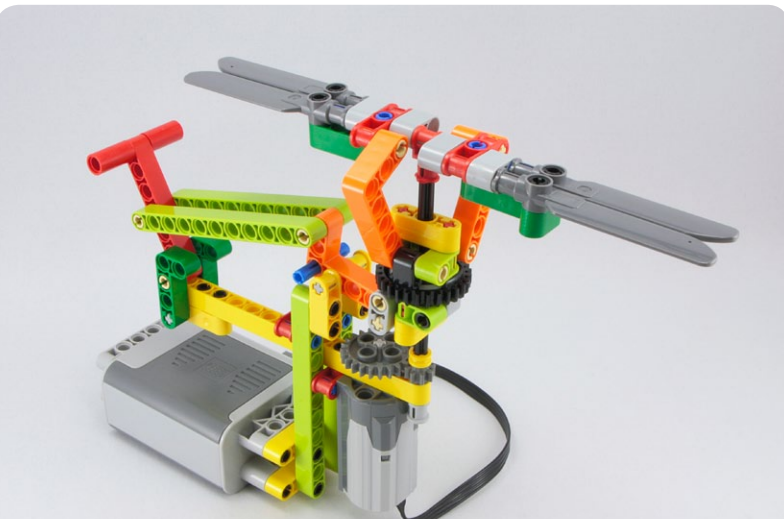
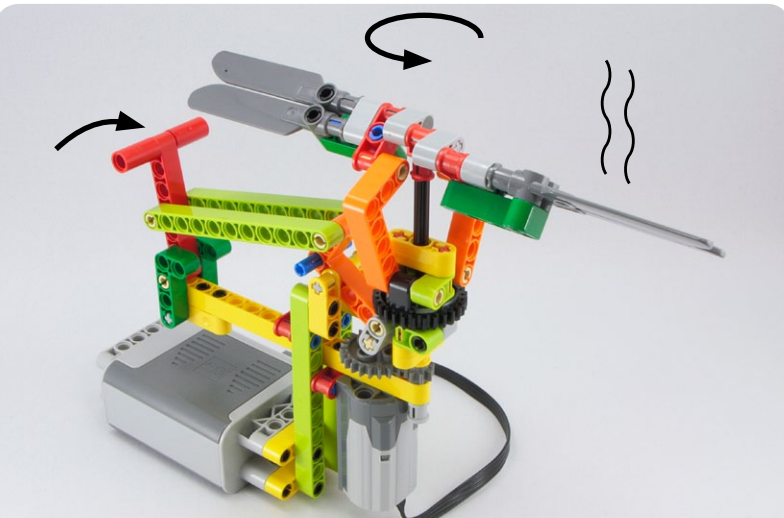
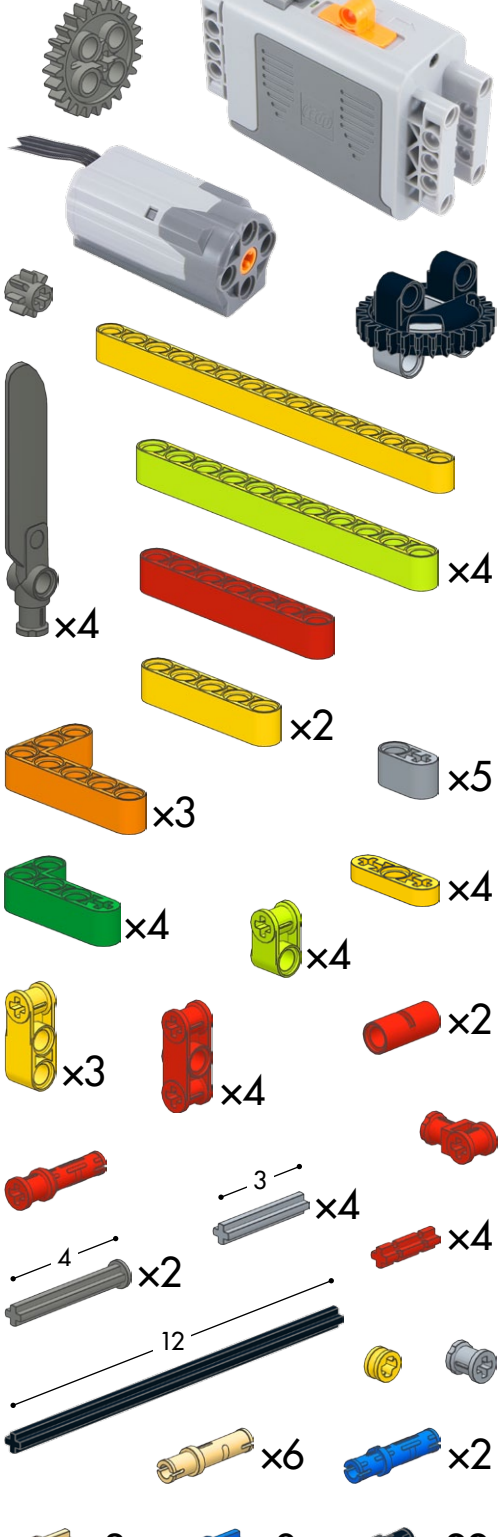


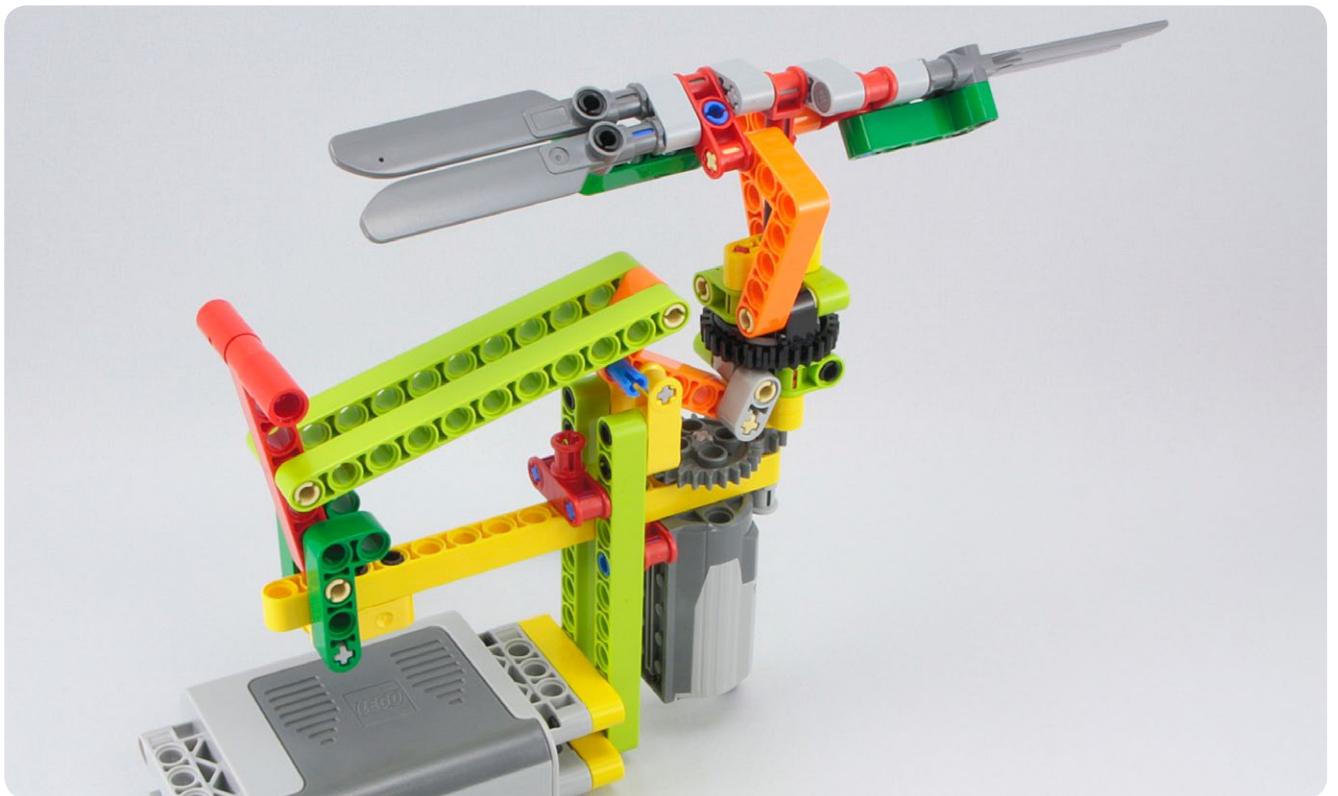
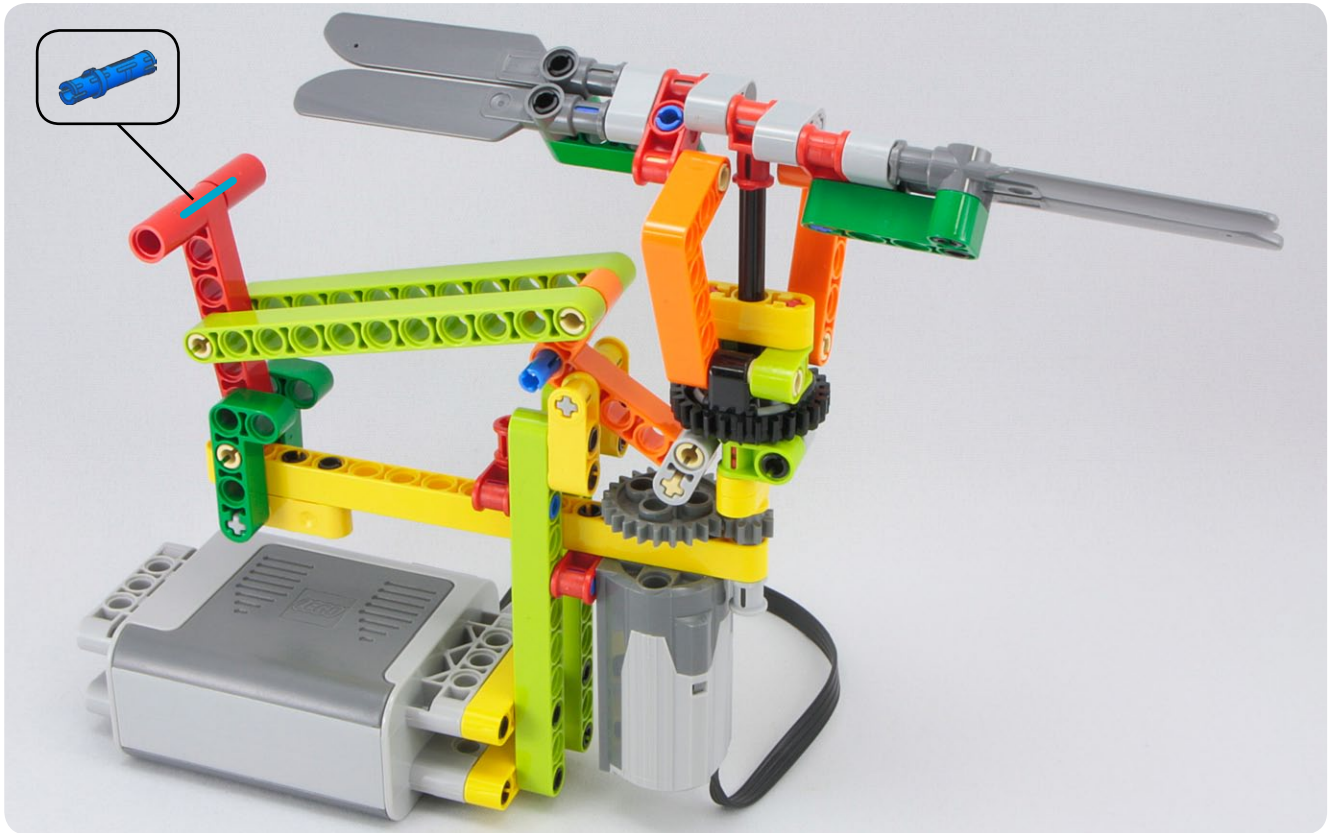
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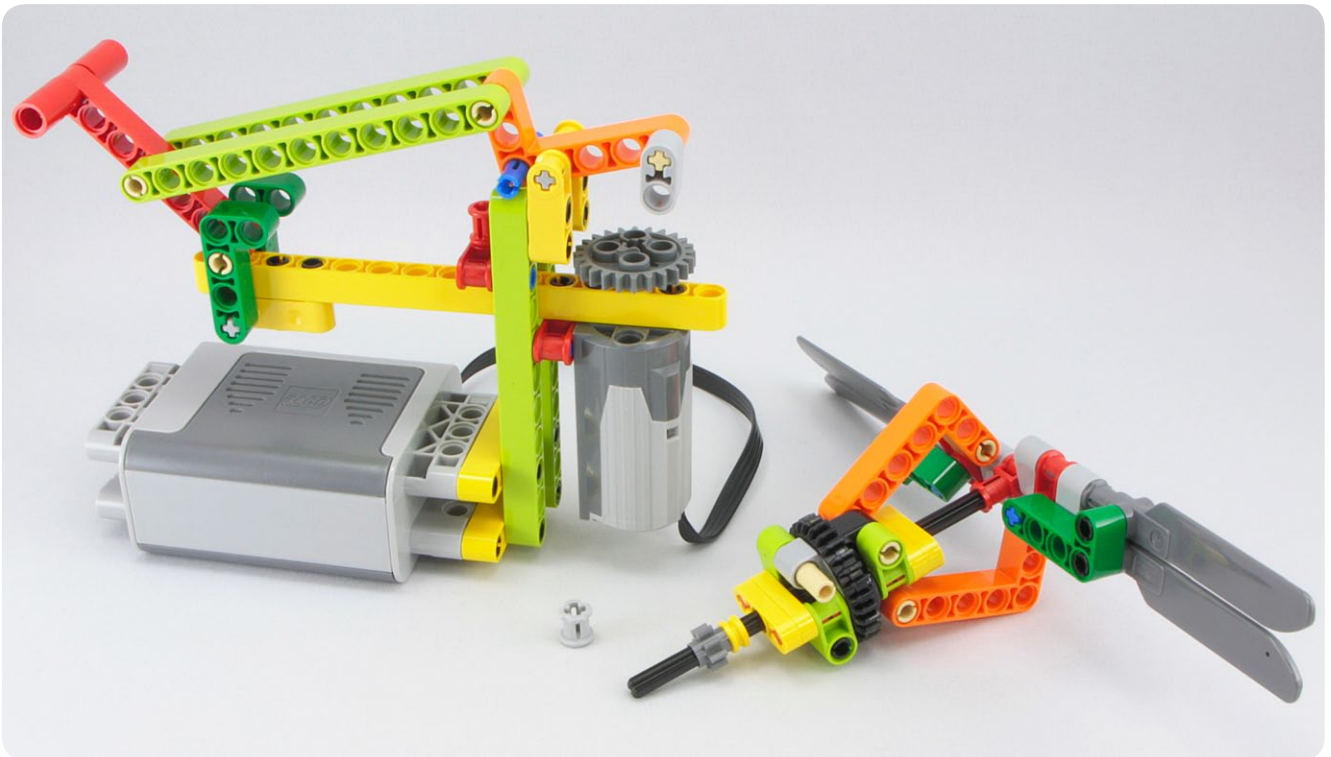
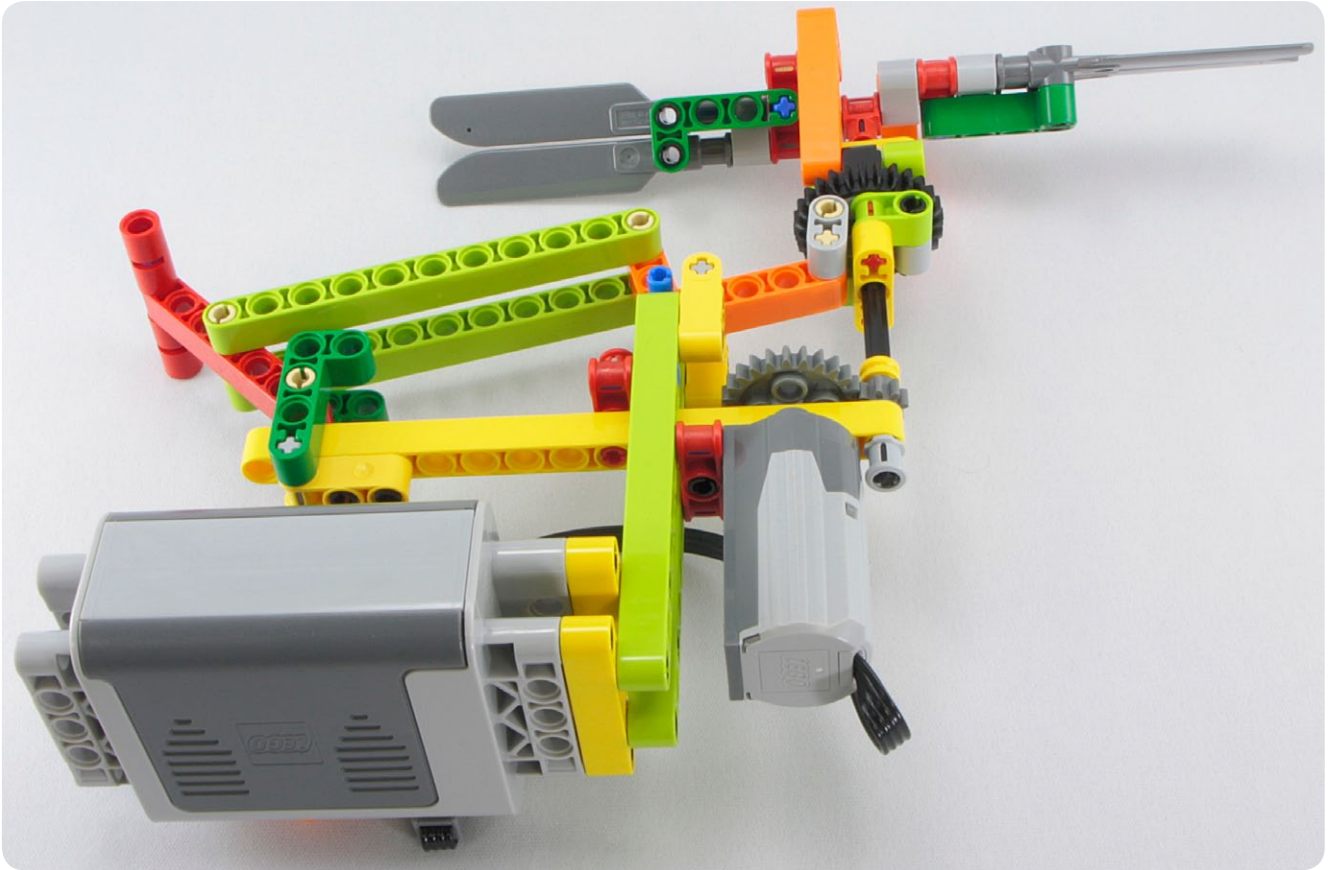


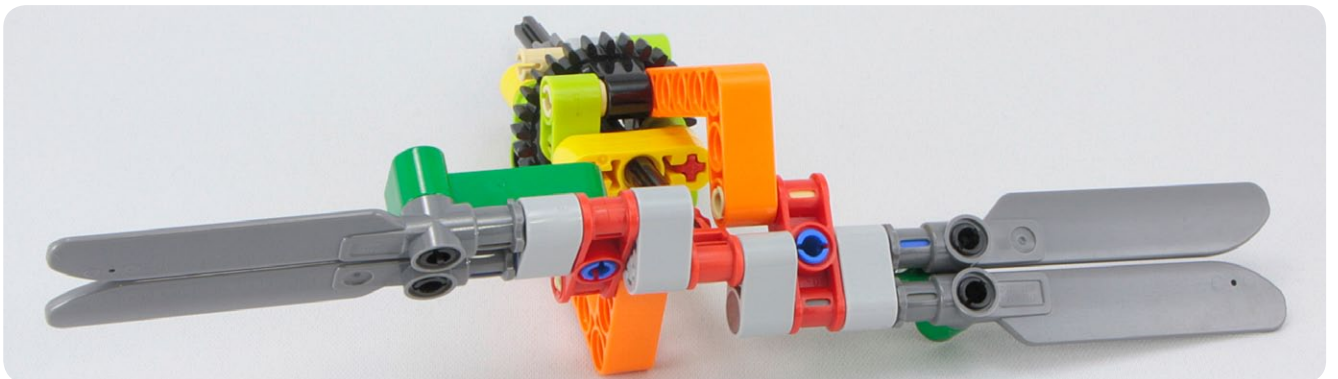
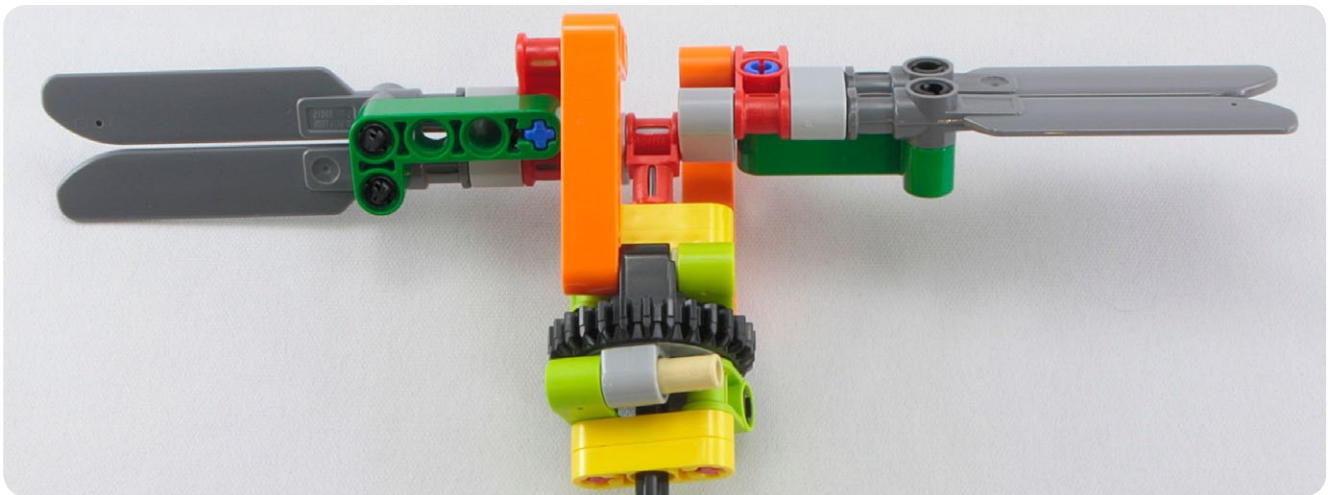
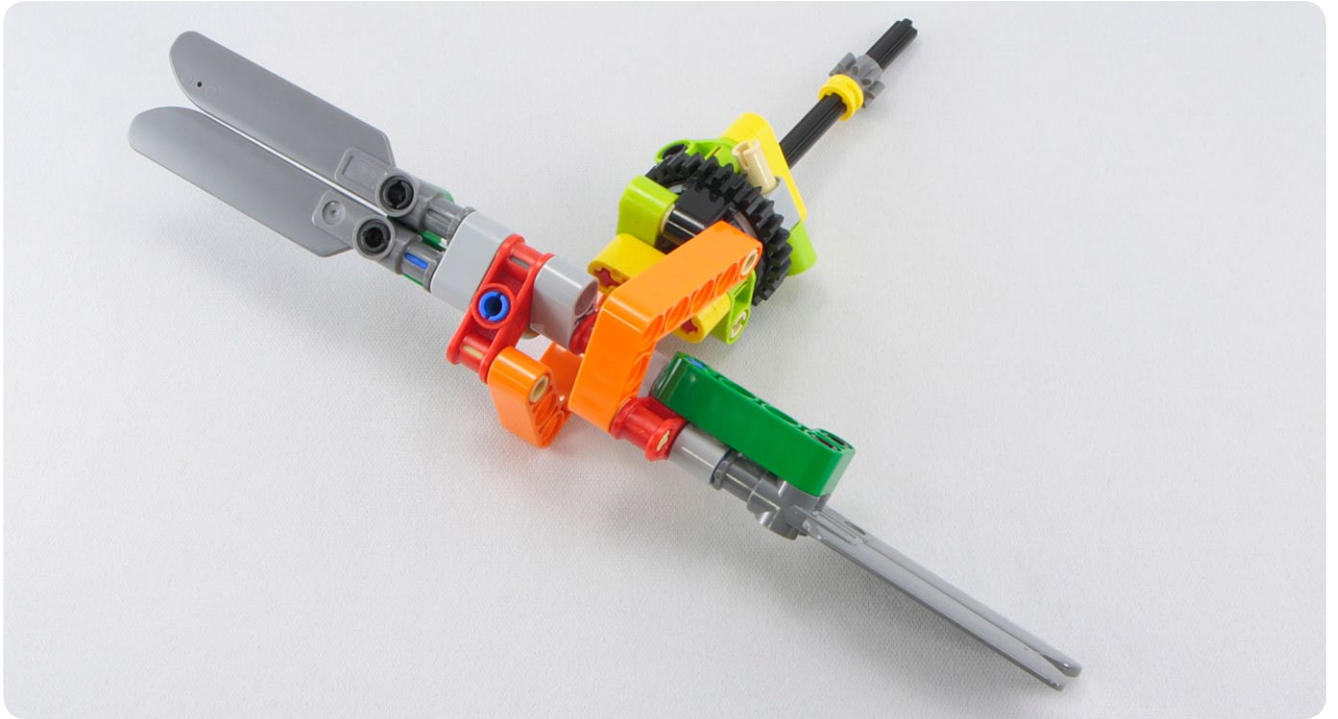


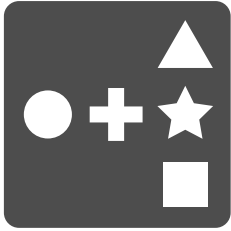
#269











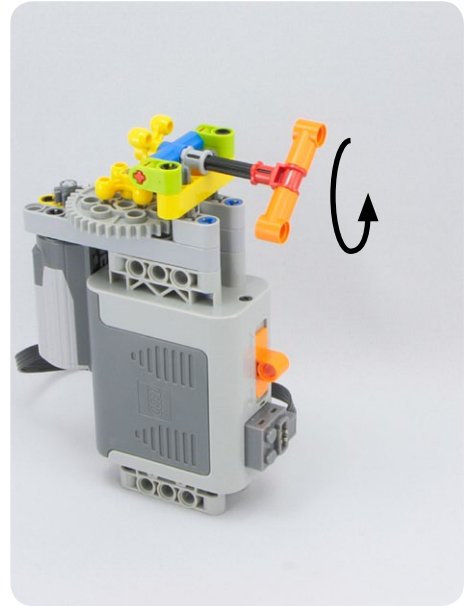
Using attachments to change motion



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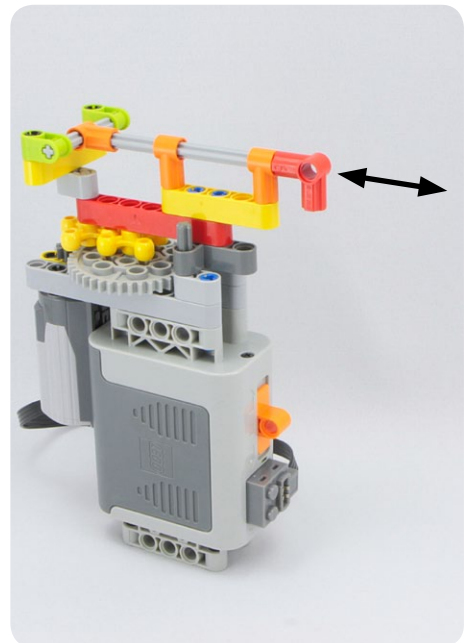
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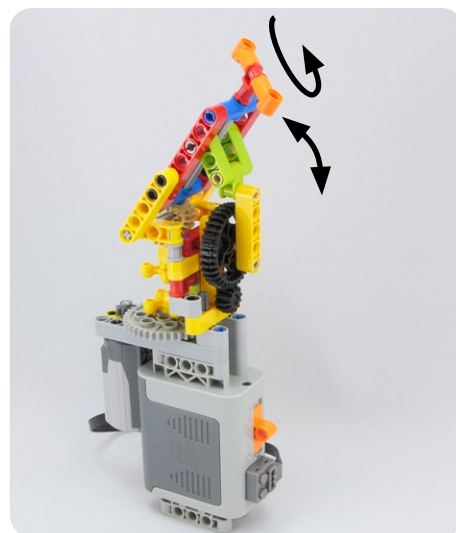
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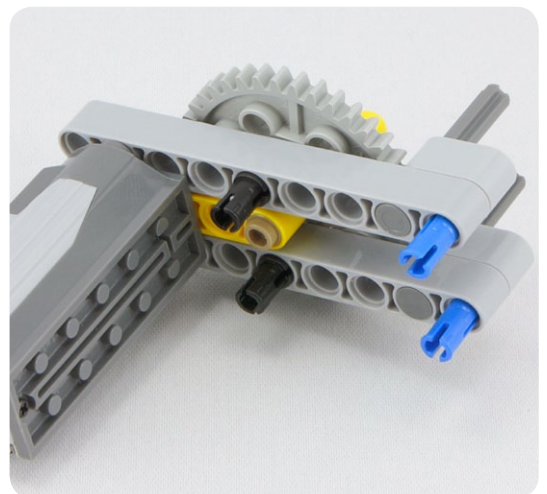
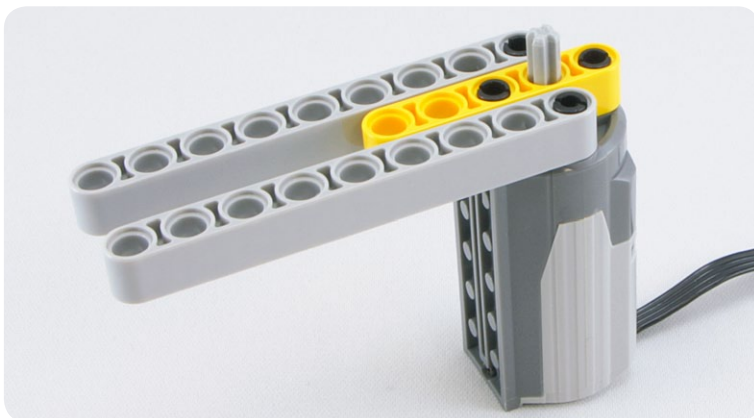


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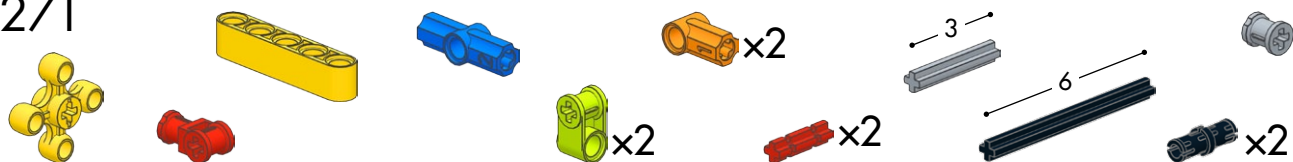


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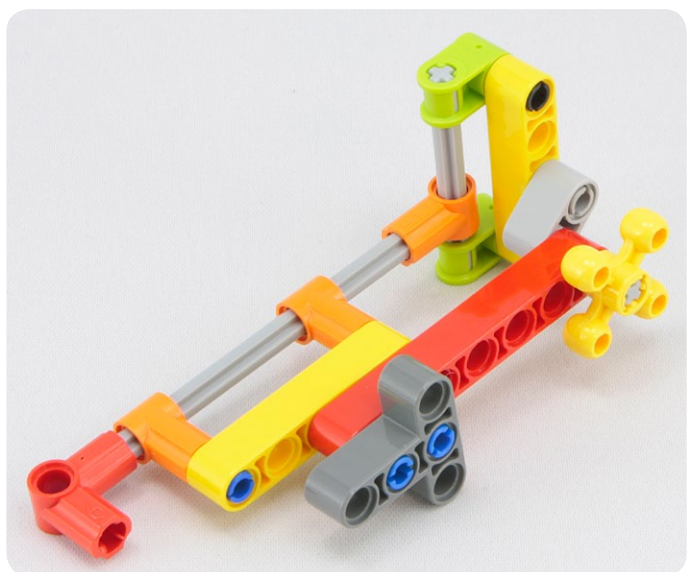
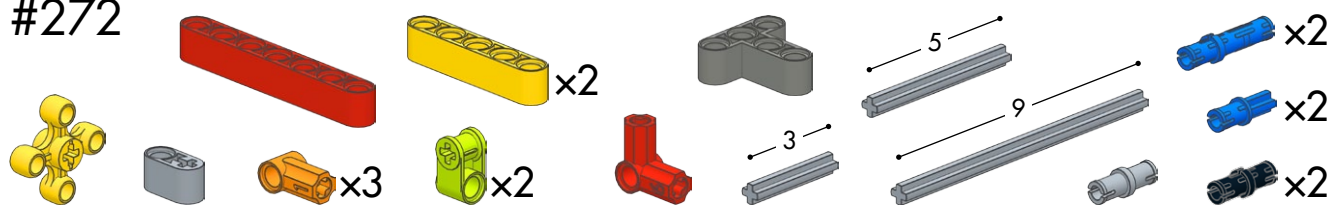


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#271

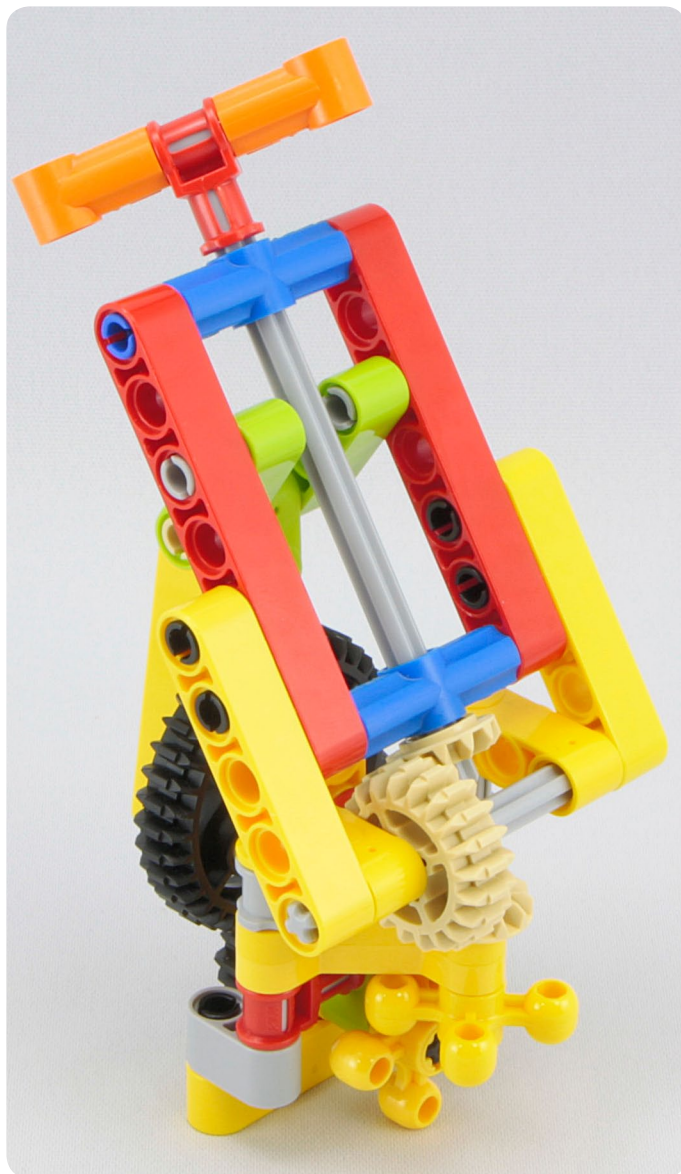
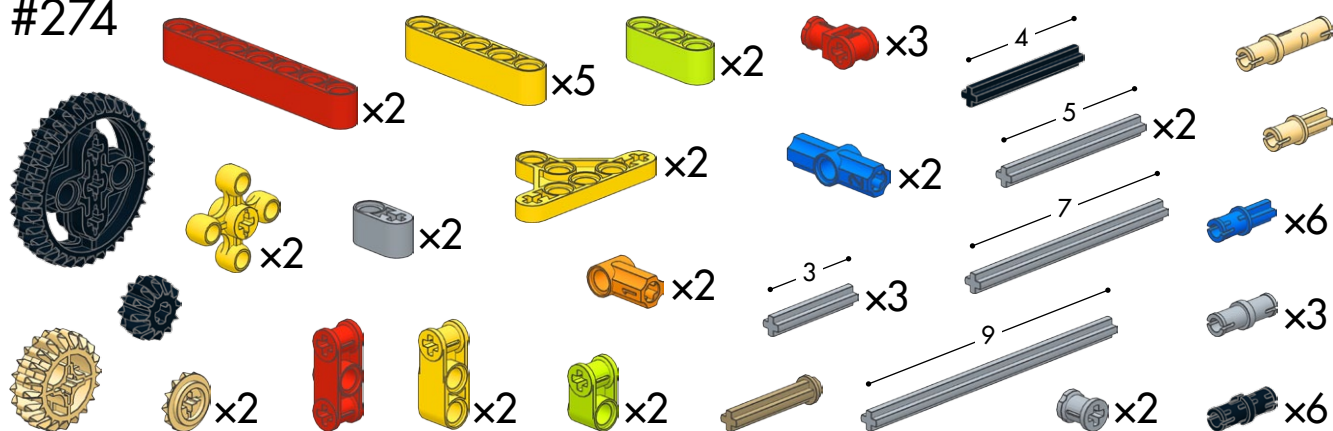


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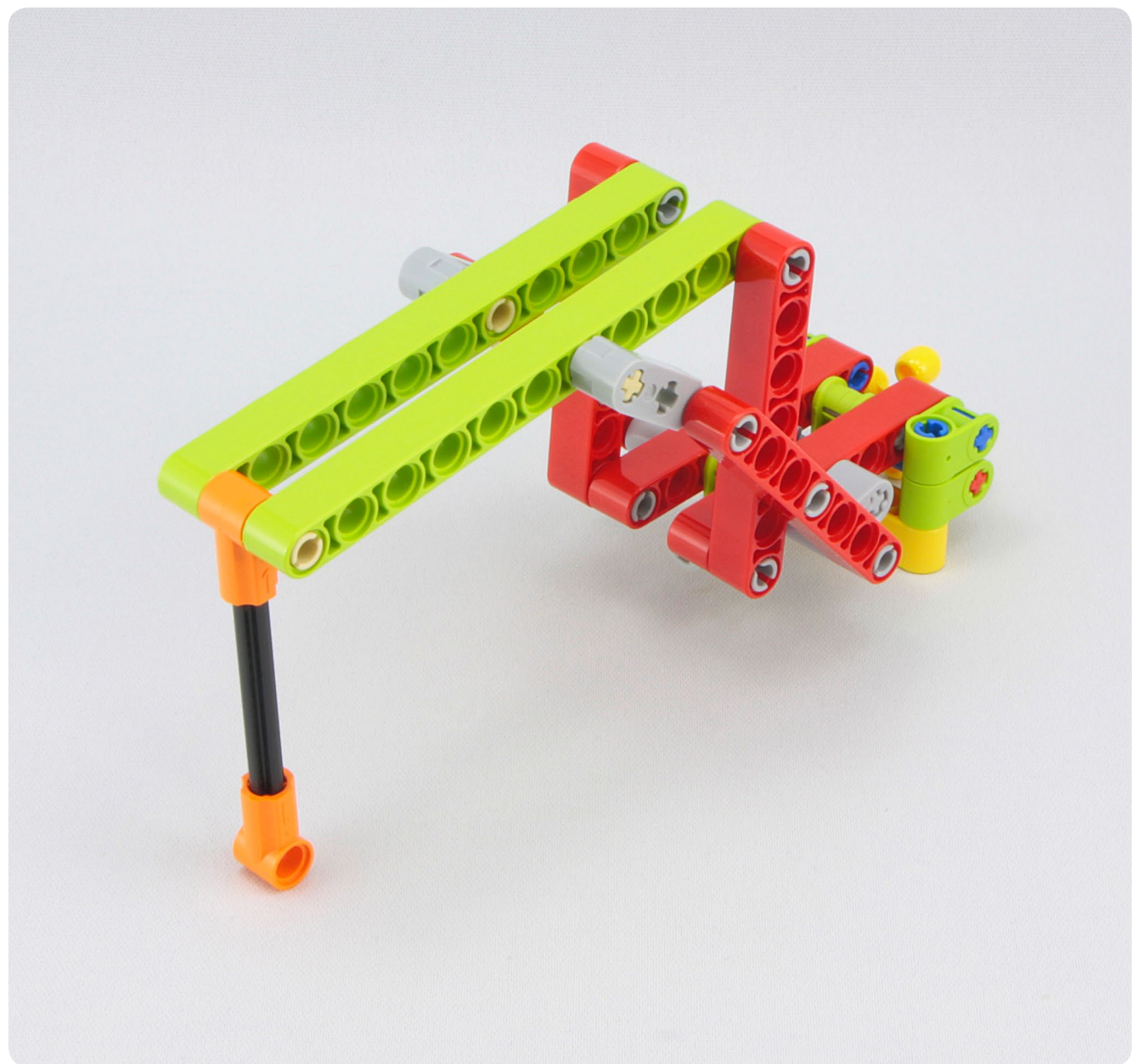
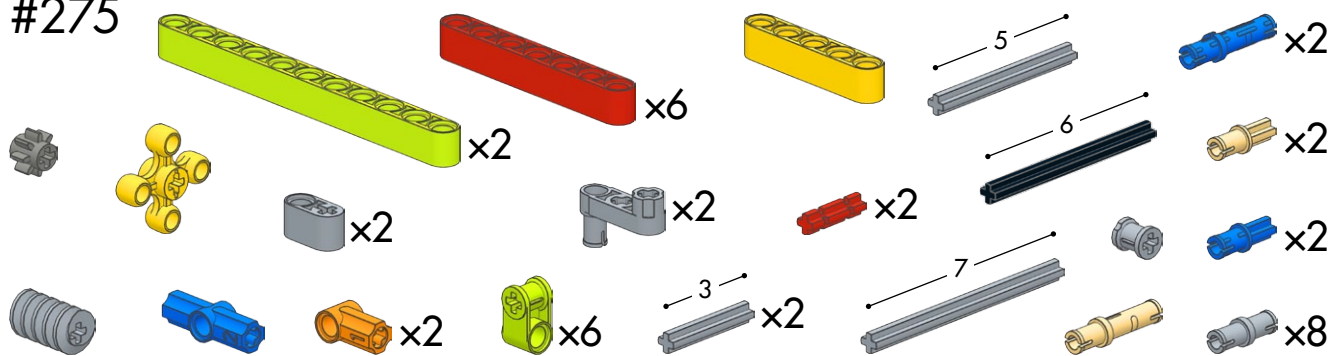
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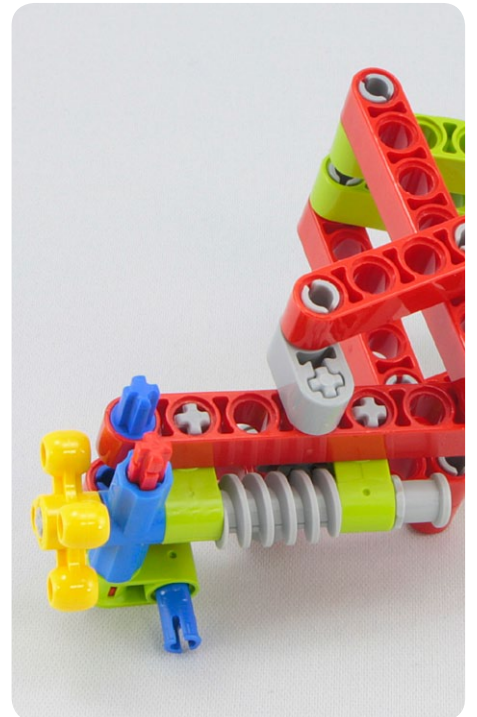
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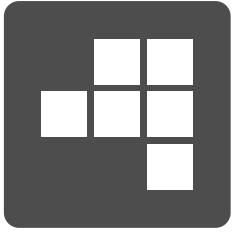




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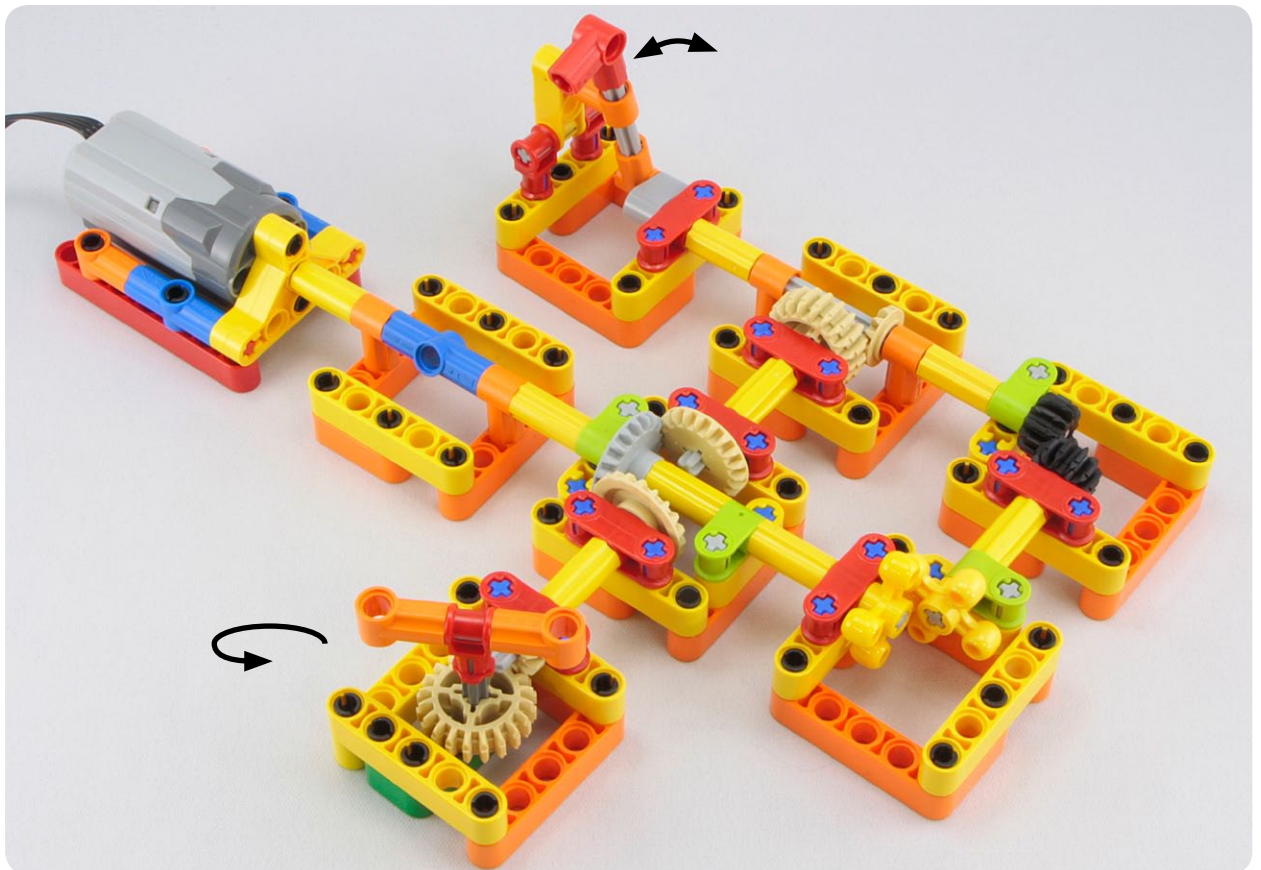
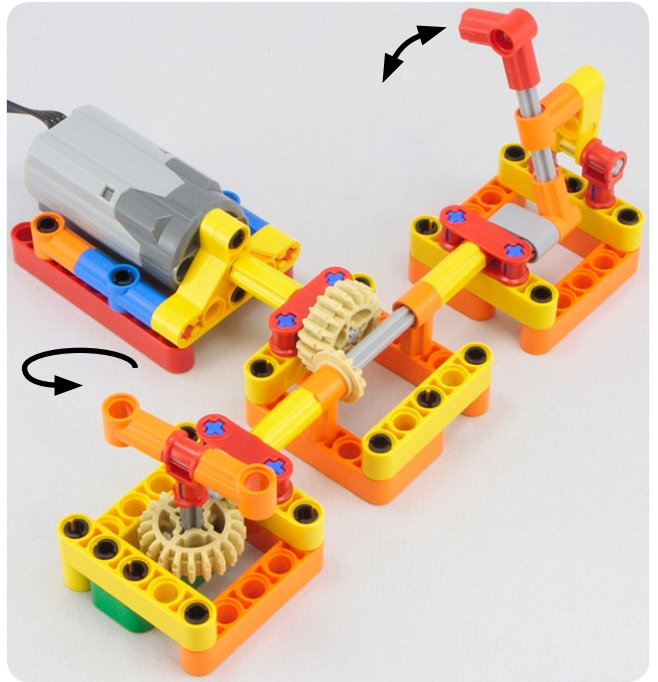
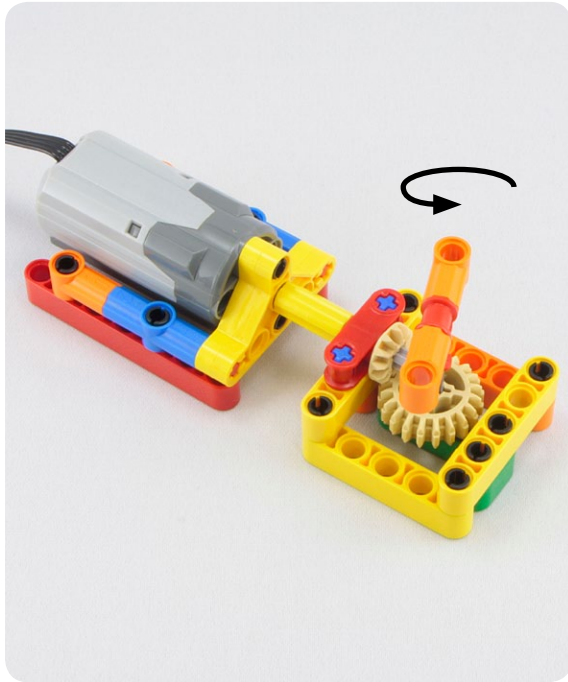




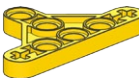


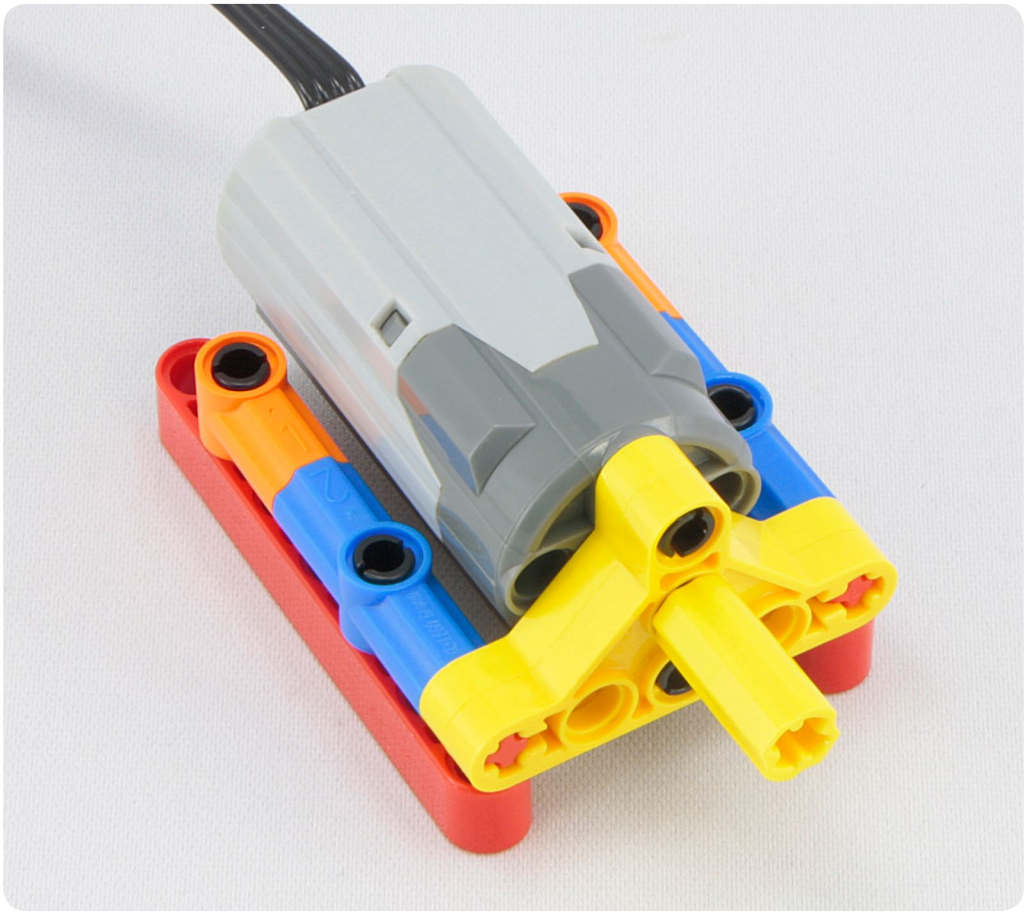
Combining modules



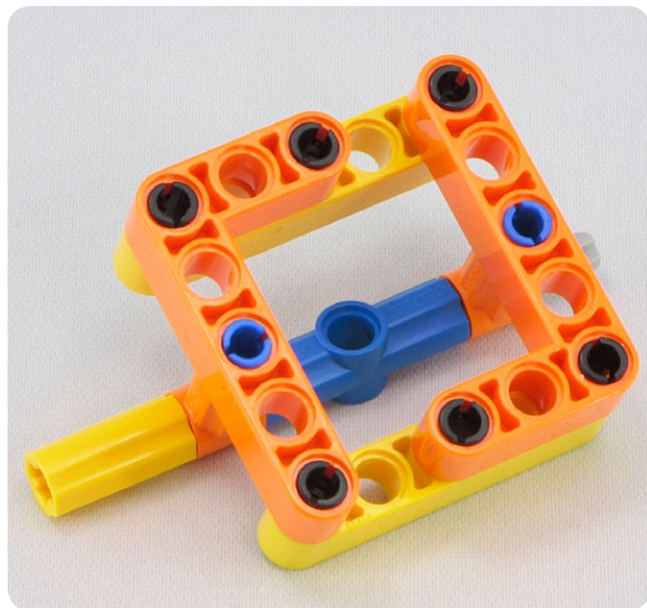
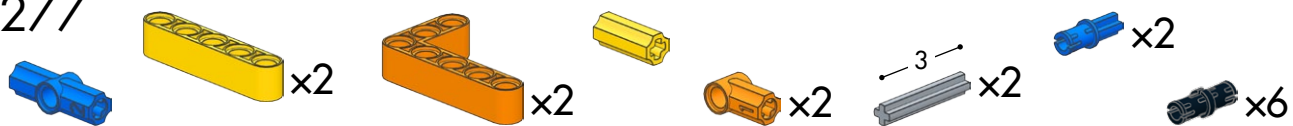


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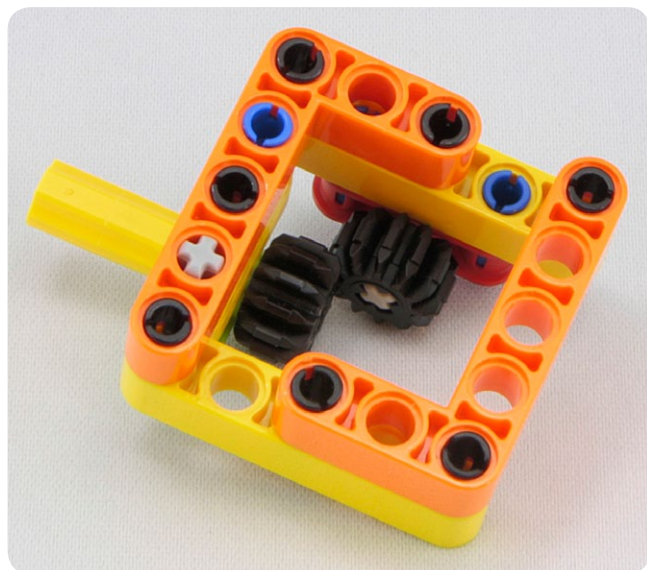
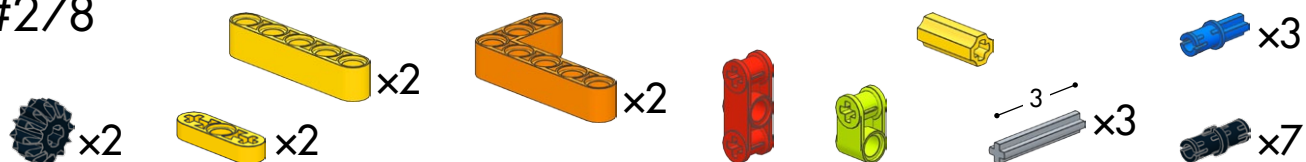
-  x2
- 
-  x2
-  x2
-  x2
- 
-  x4
-  3
-  x6



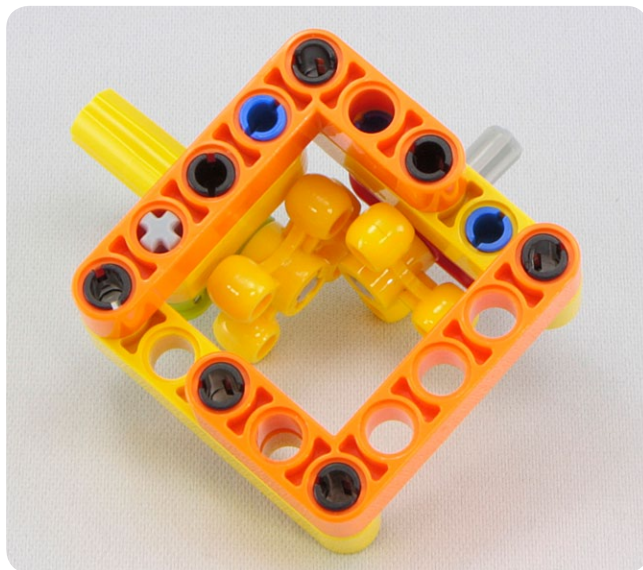
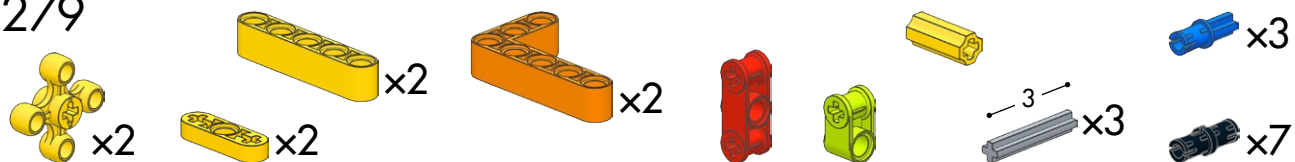
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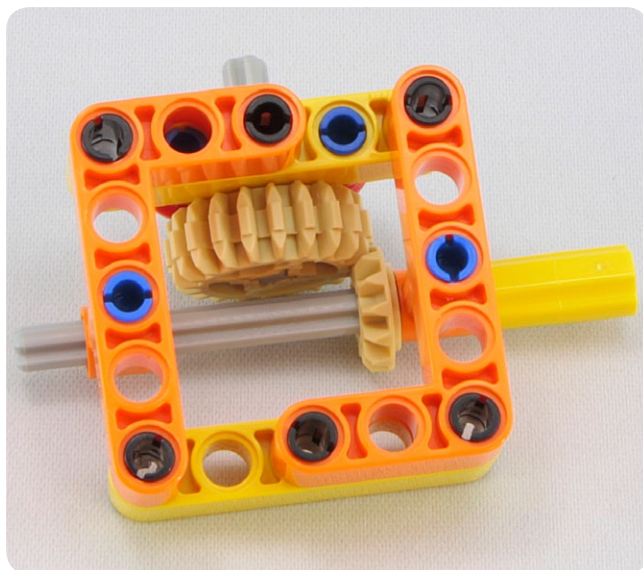
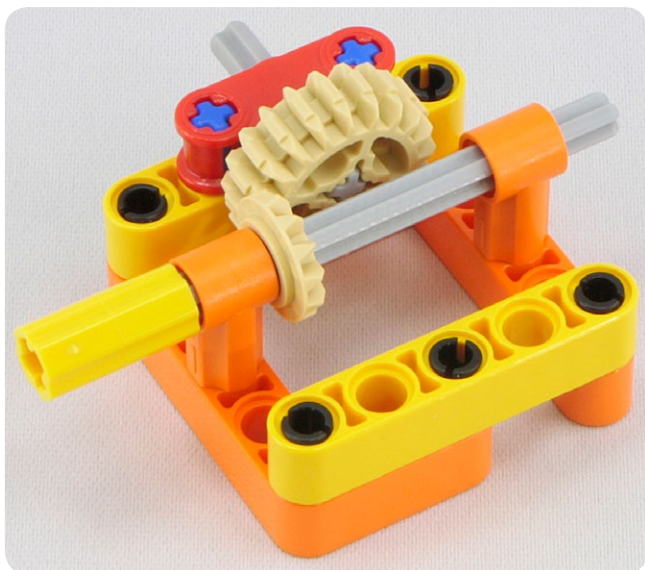
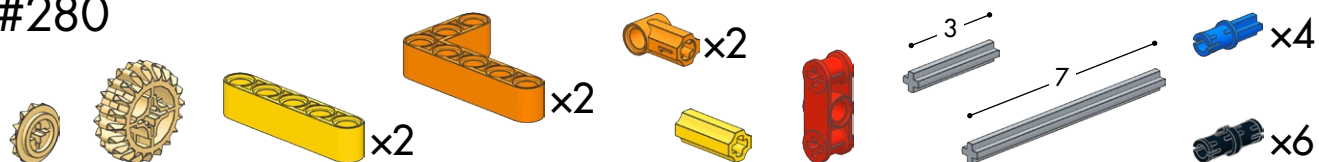
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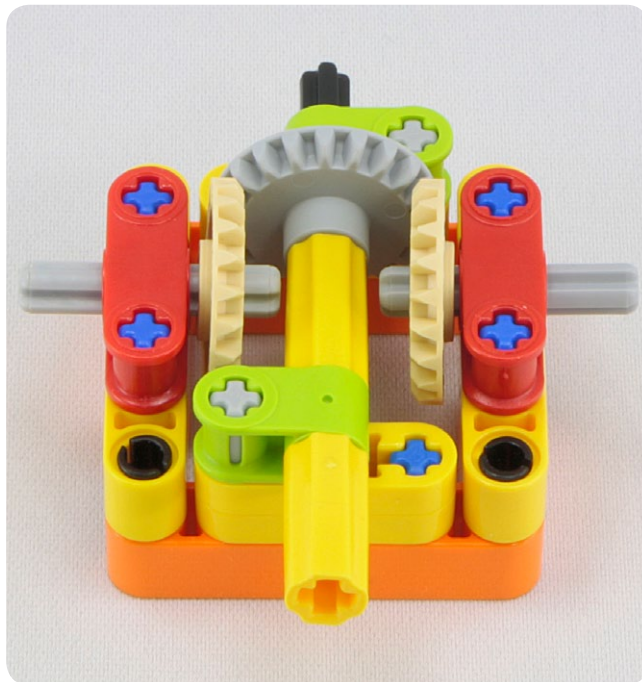
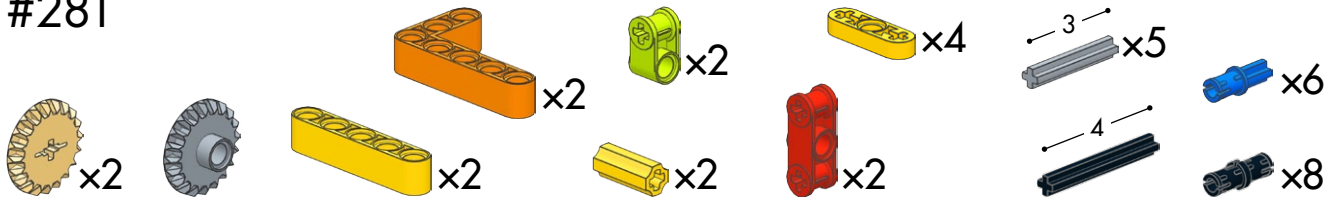
#279



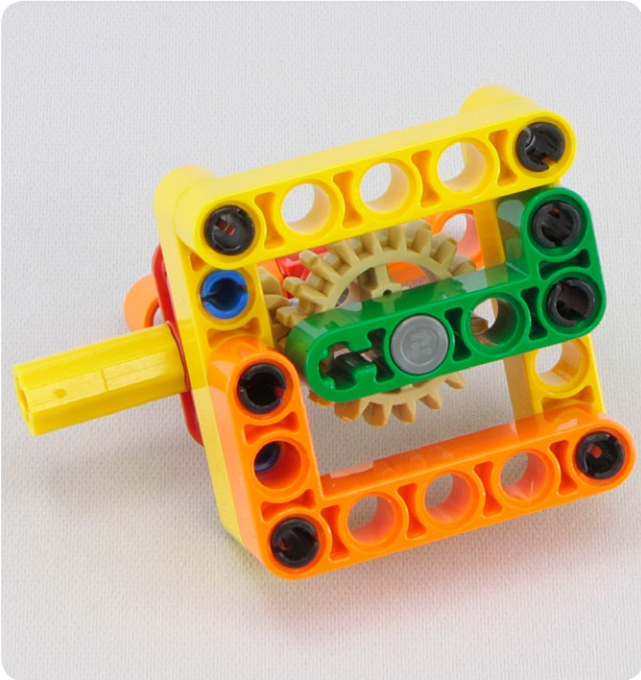
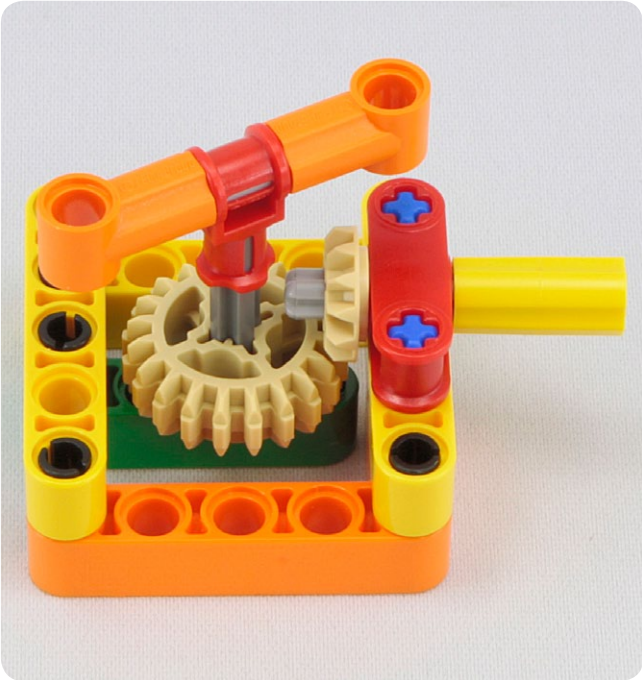
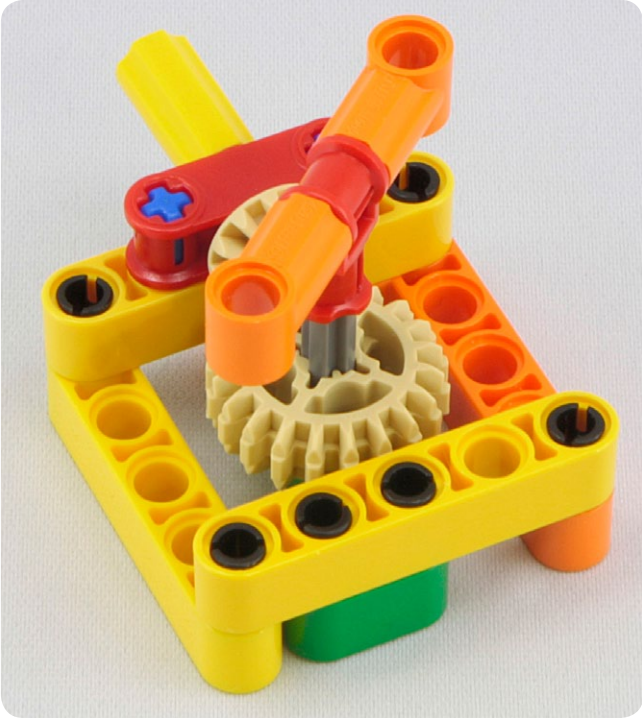
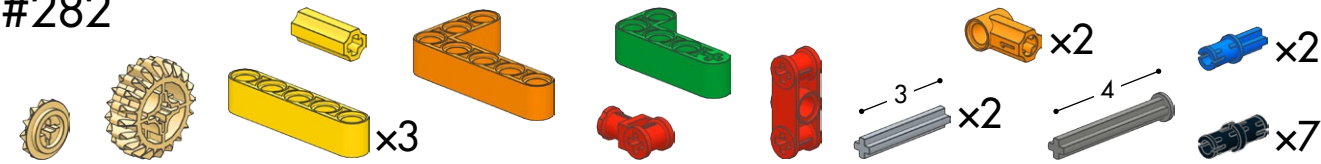
#280



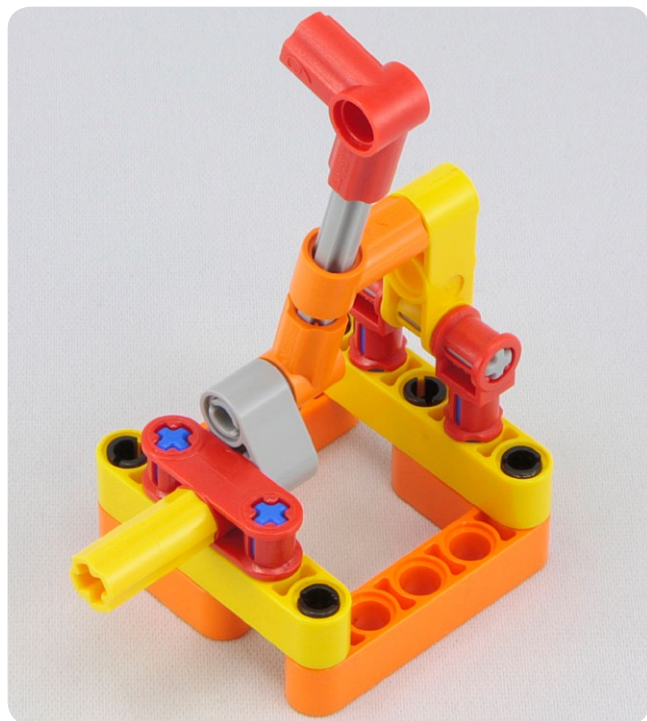
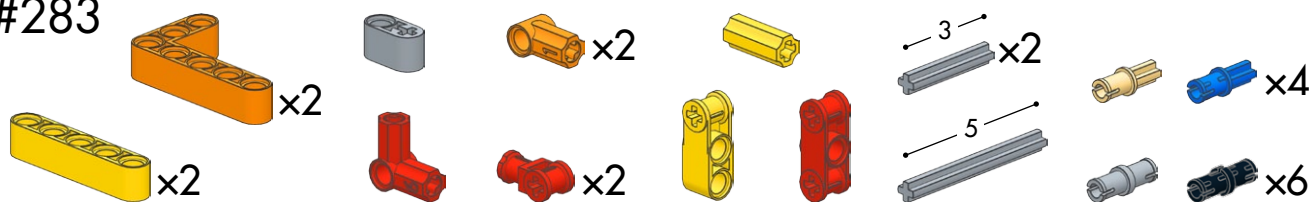
#281



#282



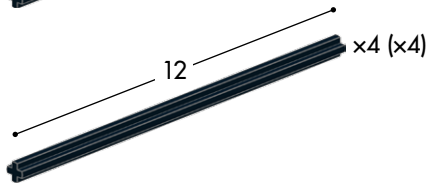
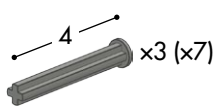
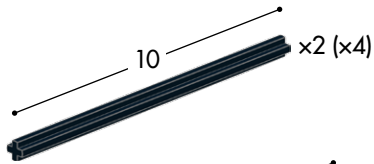
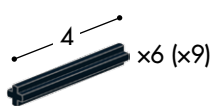
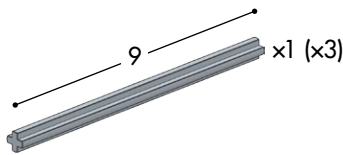
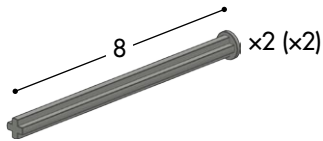
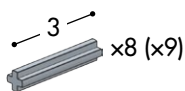
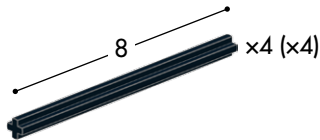
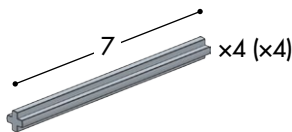
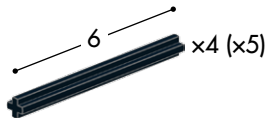
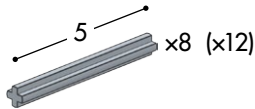
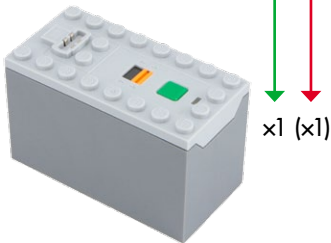
#283

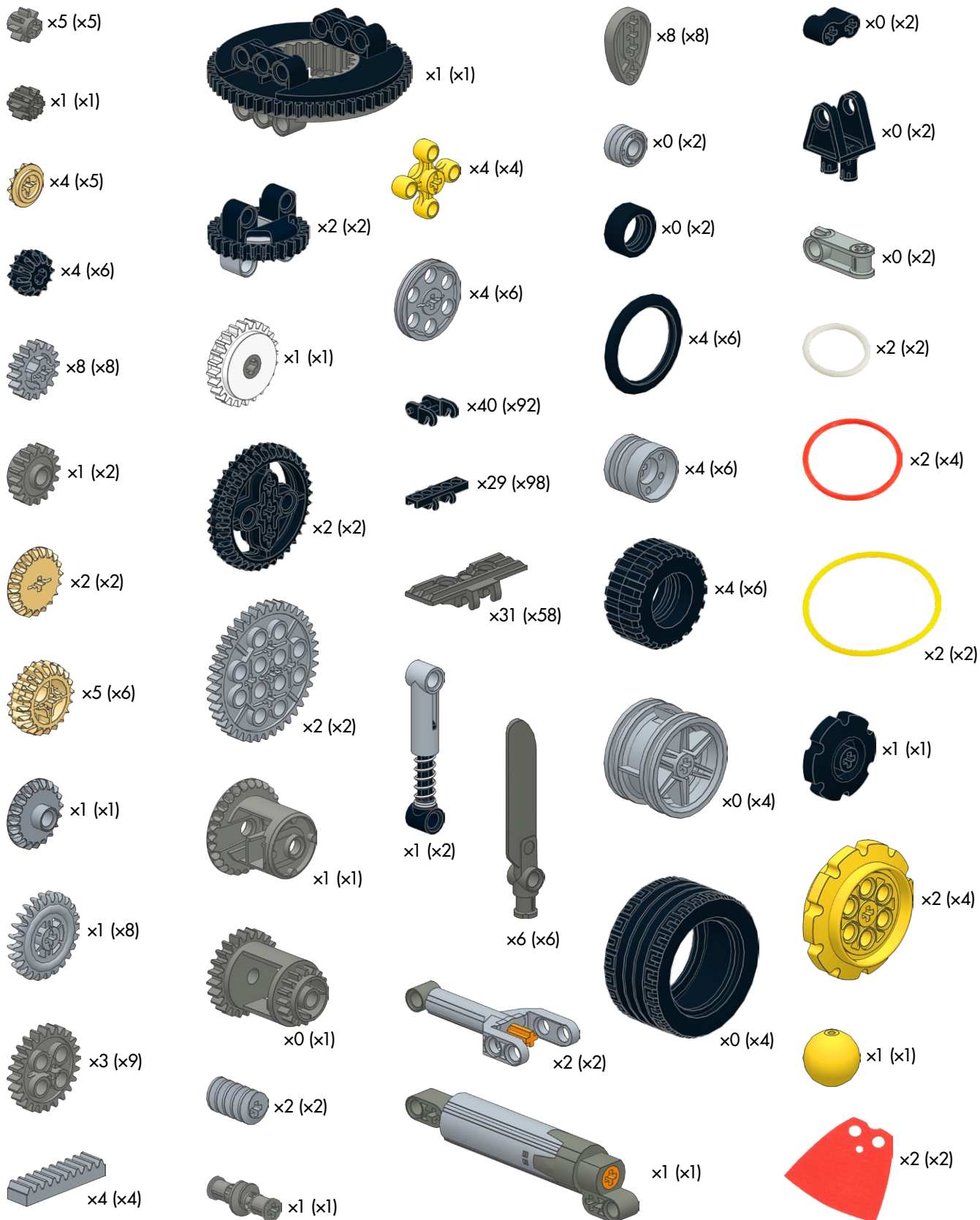


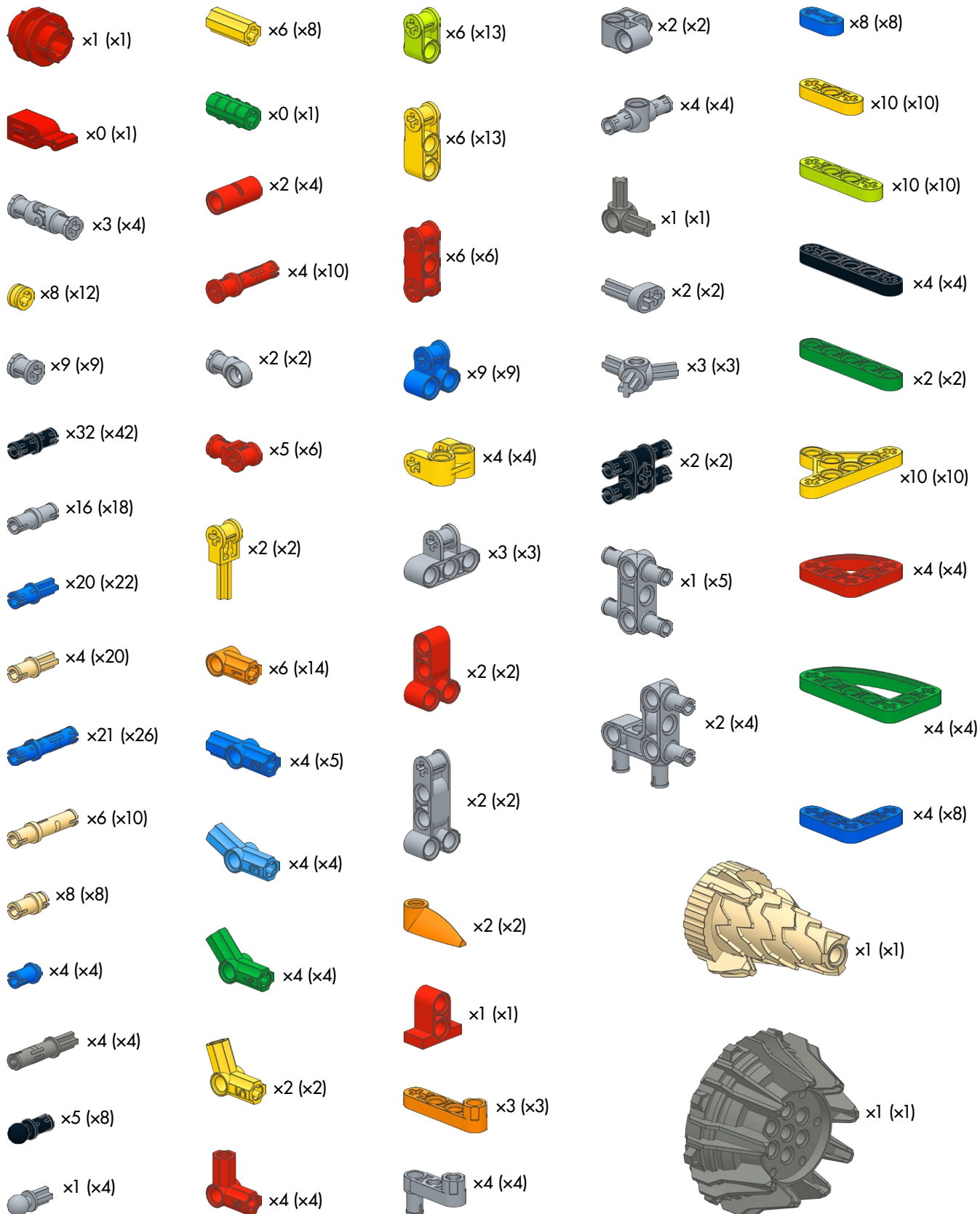
Parts list

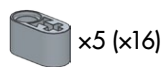
This is the maximum number of this part needed to build any single model in this book.

This is the maximum number of this part needed to build any single model in *both* volumes of *The LEGO Power Functions Idea Book* (*Machines and Mechanisms* and *Cars and Contraptions*).





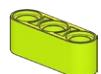




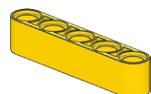
x5 (x16)



x2 (x2)



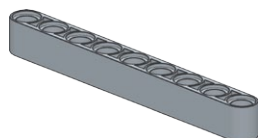
x6 (x6)



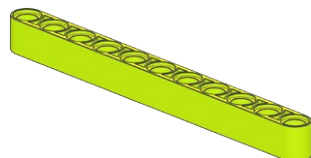
x6 (x10)



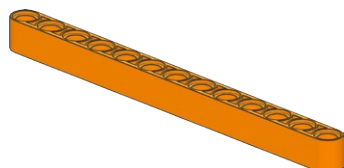
x7 (x7)



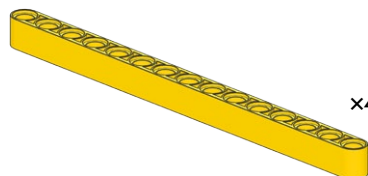
x3 (x6)



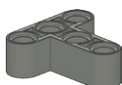
x6 (x6)



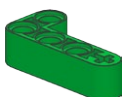
x2 (x2)



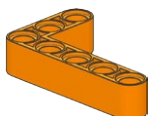
x4 (x4)



x3 (x4)



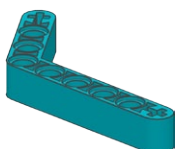
x6 (x10)



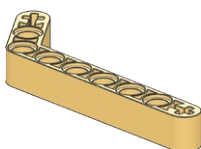
x8 (x8)



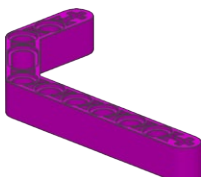
x4 (x4)



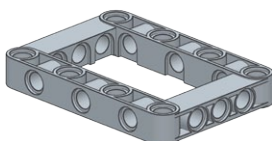
x4 (x4)



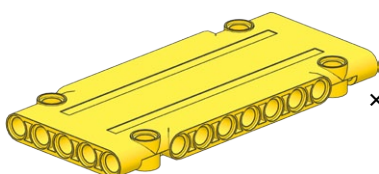
x4 (x4)



x2 (x2)



x1 (x1)



x3 (x3)



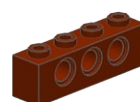
x2 (x2)



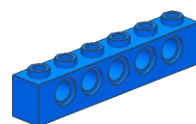
x0 (x2)



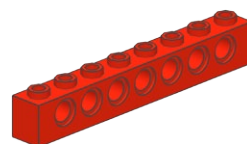
x2 (x2)



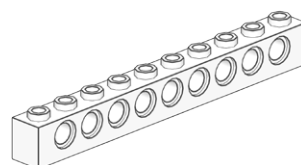
x5 (x5)



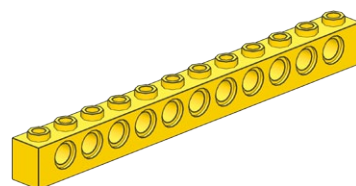
x4 (x4)



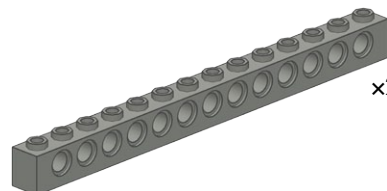
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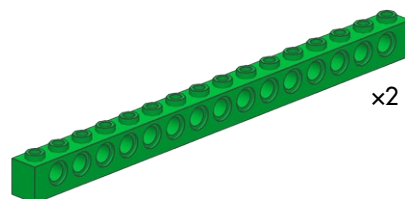
x2 (x2)



x2 (x2)



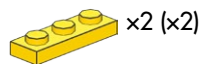
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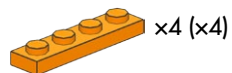
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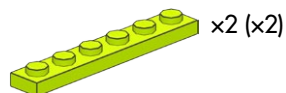
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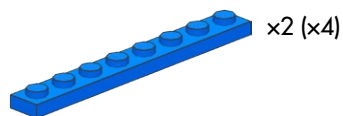
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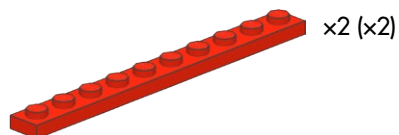
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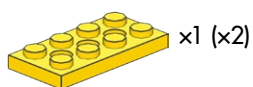
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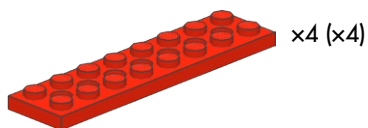
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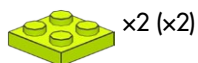
x2 (x2)



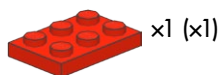
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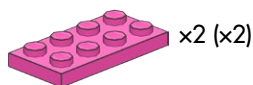
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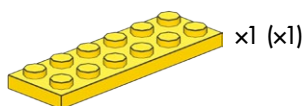
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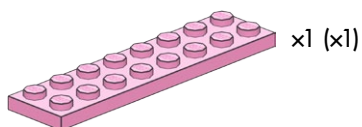
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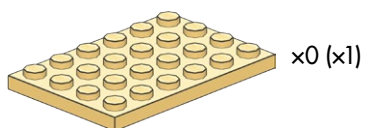
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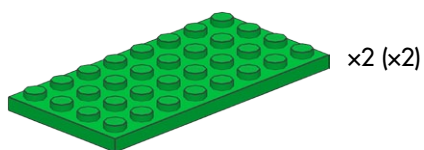
x1 (x1)



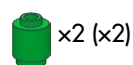
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x0 (x1)



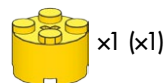
x2 (x2)



x2 (x2)



x1 (x1)



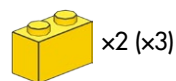
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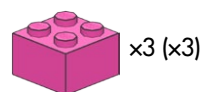
x1 (x1)



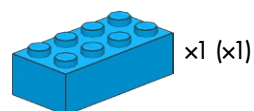
x2 (x2)



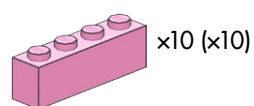
x2 (x3)



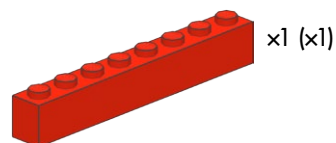
x3 (x3)



x1 (x1)



x10 (x10)



x1 (x1)

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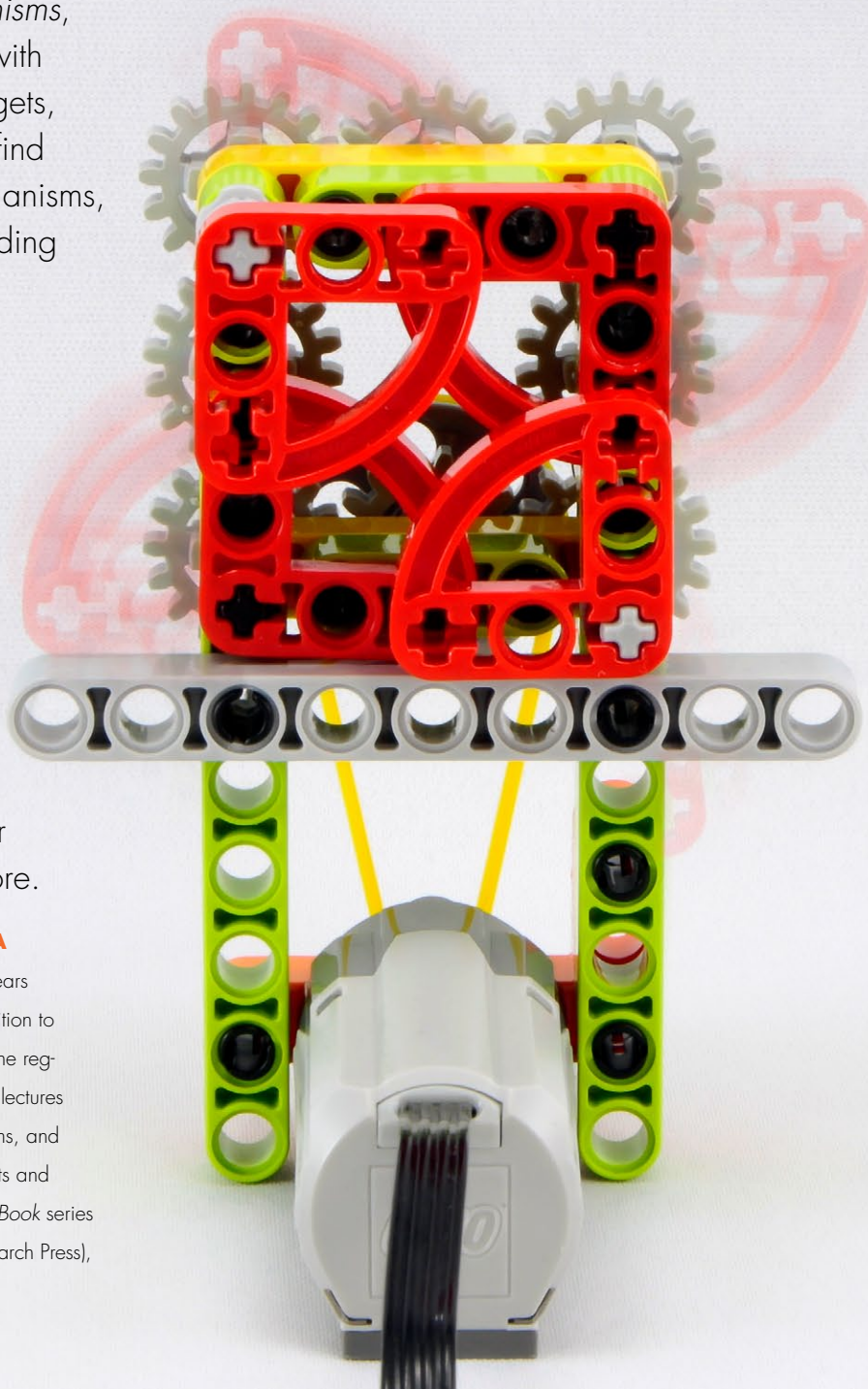
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