DISCOVER E! KIT
Inspire Tomorrow's Engineers

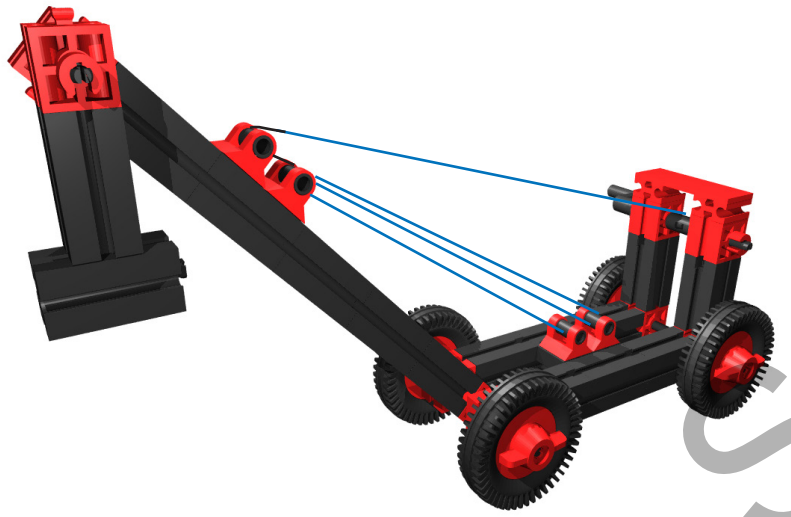
v020113

Project #1

PULLEYS

Engineering

Crane



Each step is color coded in order of assembly.

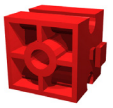
- First
- Second
- Third
- Fourth
- Fifth
- Sixth

Icon Legend

- Set assembly aside.
- Build the number shown.
- Rotate assembly.
- Flip assembly.

Materials you will need:

Building Block 30 (Qty 15)

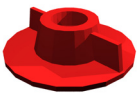


Building Block 15 with Bore (Qty 9)

Building Block 15 with 2 Pins (Qty 2)

Tire 45 (Qty 4)

String (Qty 1)

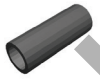


Hub Nut (Qty 4)

Flat Hub Collet (Qty 4)

Clip Axle 30 (Qty 2)

Clip Axle 75 (Qty 2)



Bearing Sleeve (Qty 4)

Axle Coupling (Qty 1)

Clip Axle 45 (Qty 1)

Clip 5 (Qty 3)

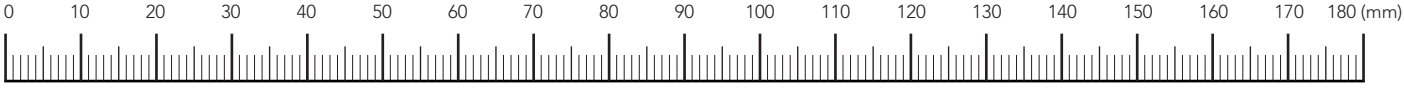
Building Block 7.5 (Qty 2)

Hinged Block Claw (Qty 4)

Crank Shaft (Qty 1)

Spacer Ring (Qty 4)

Mounting Plate 15x45 (Qty 1)



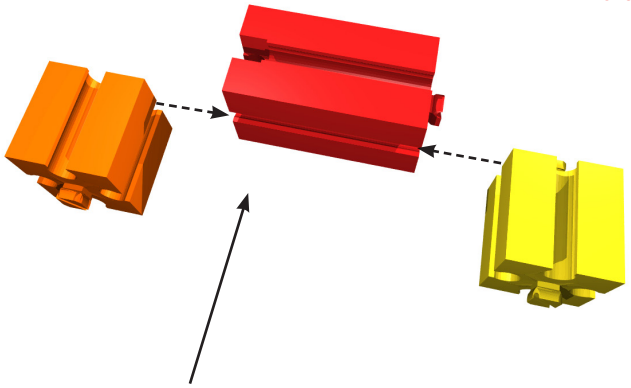
1


x1


x2

Shown in actual color.

Parts shown in color-coded building order.



All steps have an "exploded view" which helps with assembly.

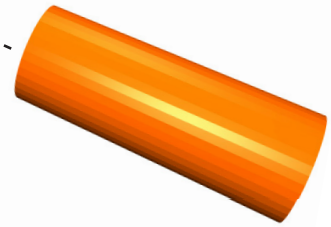
The assembly should look like this before proceeding to the next step.

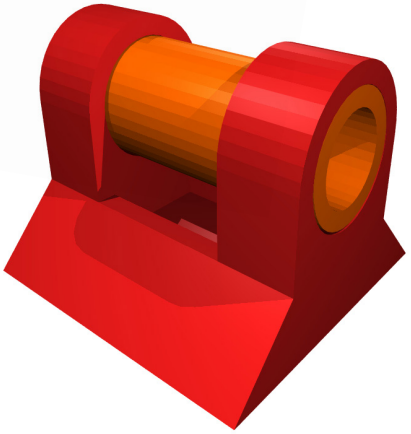
2


x2


x2

Bearing Sleeves can be challenging to insert into Hinged Block Claws. Pressing the Bearing Sleeve against a hard surface may help.





First Second Third Fourth Fifth Sixth

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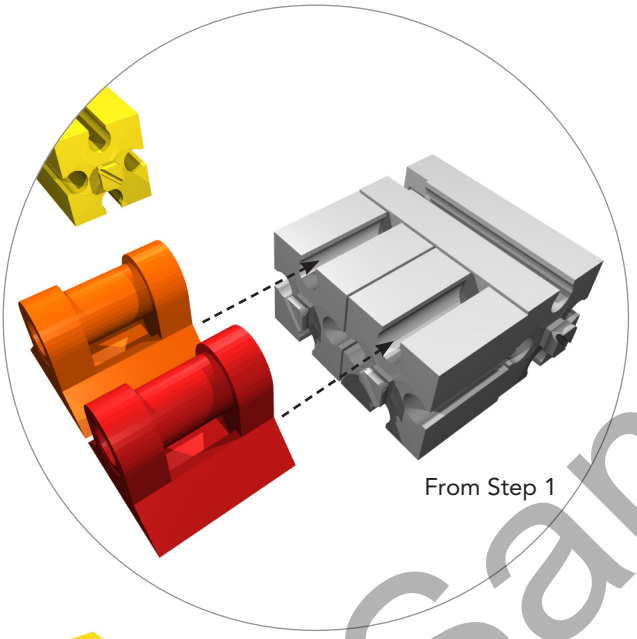
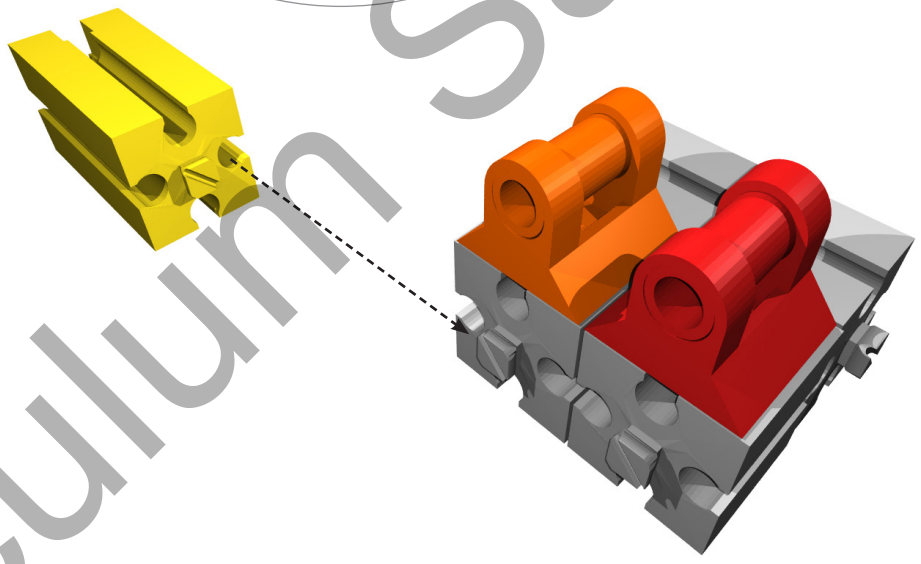
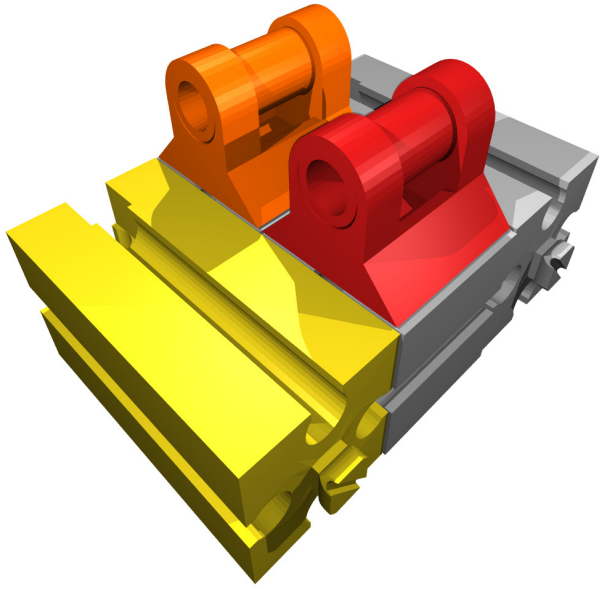
3

x1



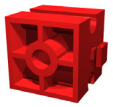


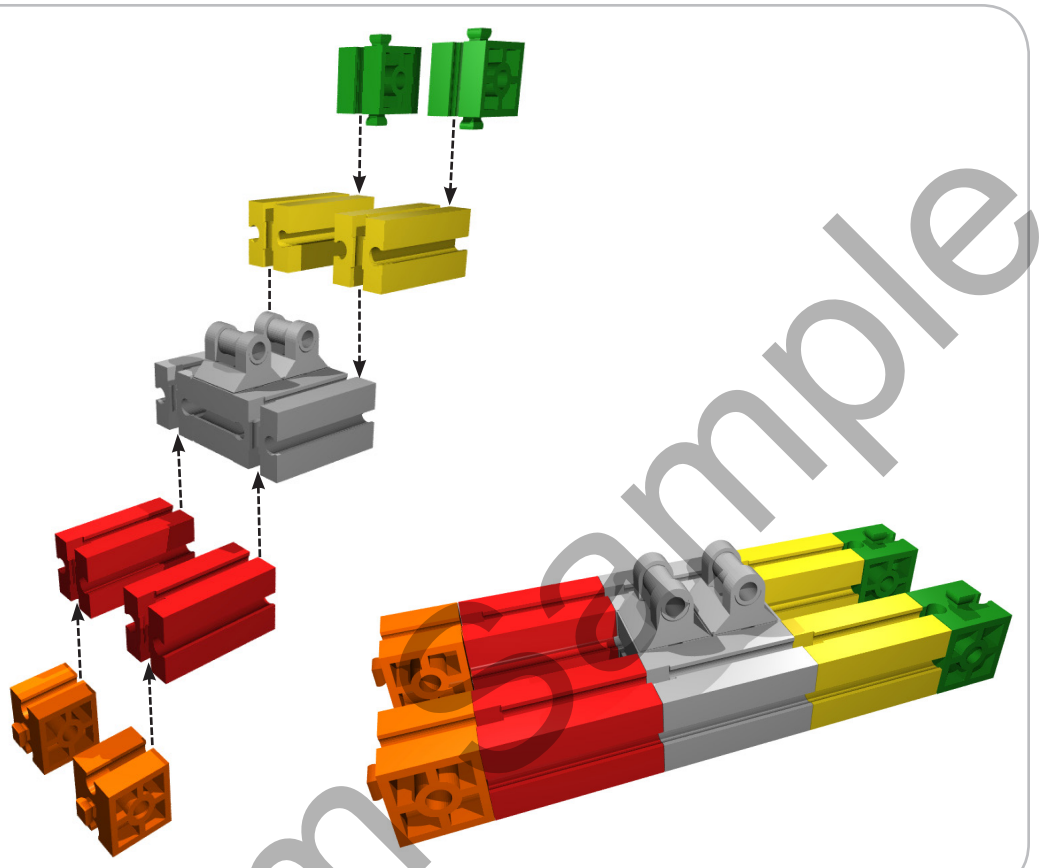


PCS edventures!

4


x4


x4



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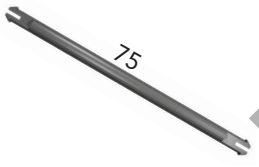
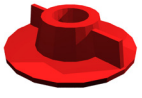


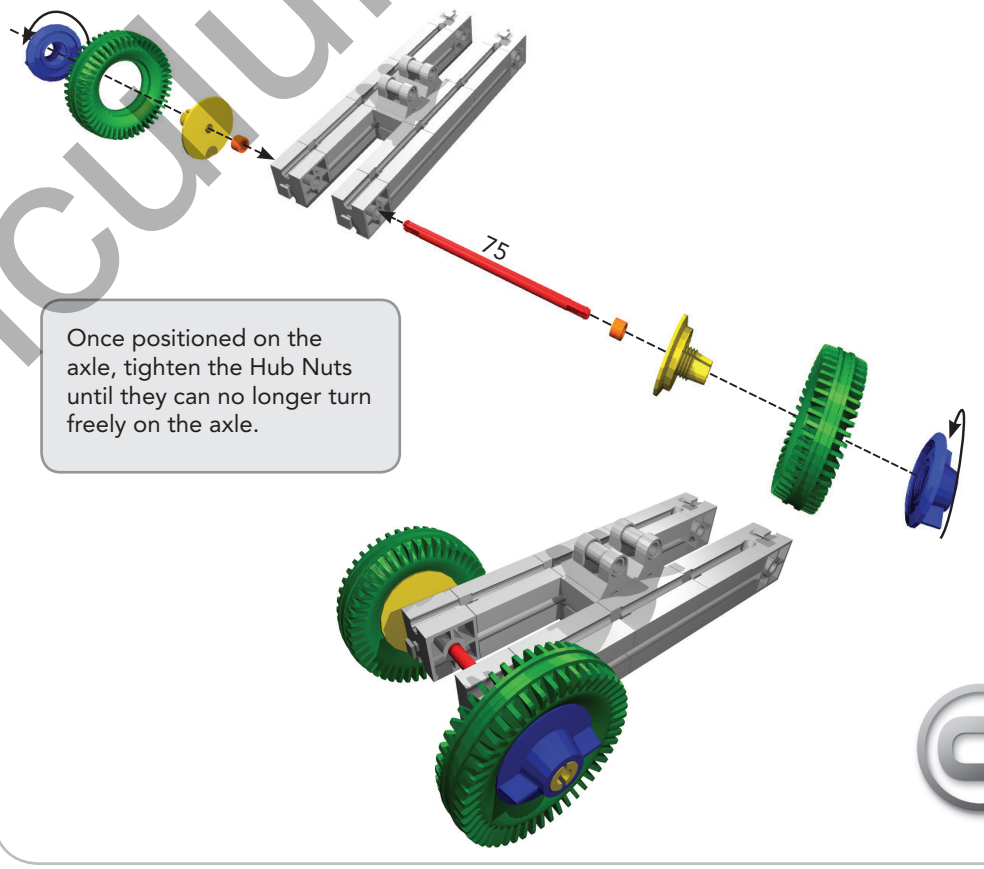
x1


x2


x2


x2

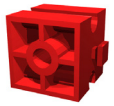

x2

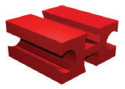


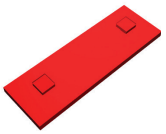
Once positioned on the axle, tighten the Hub Nuts until they can no longer turn freely on the axle.

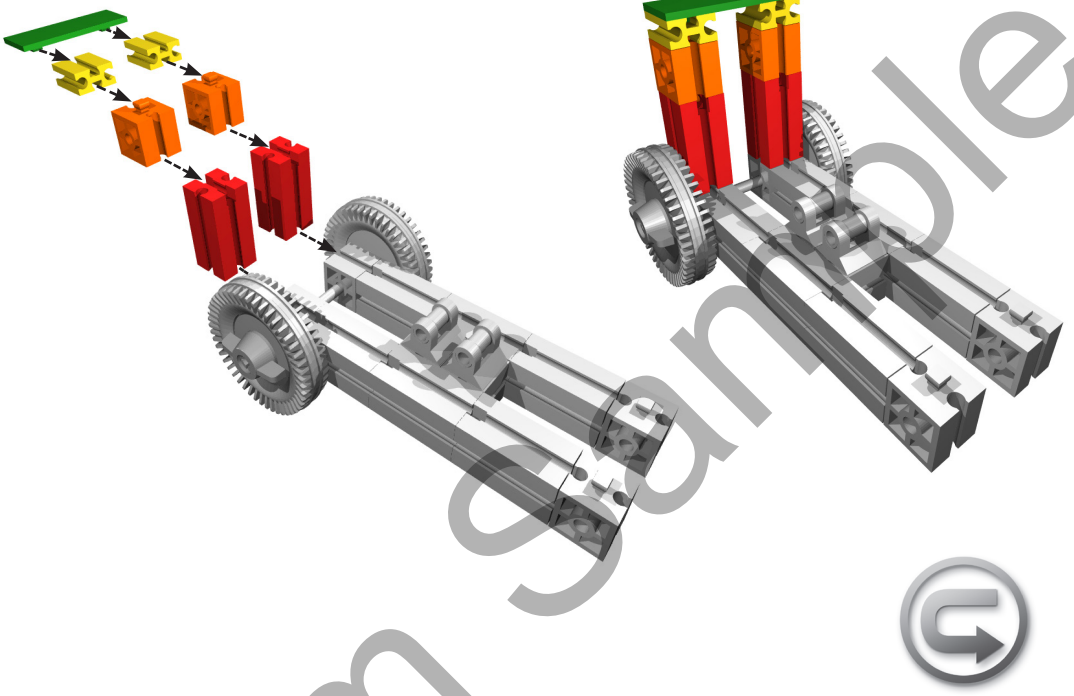
6


x2


x2


x2


x1



7

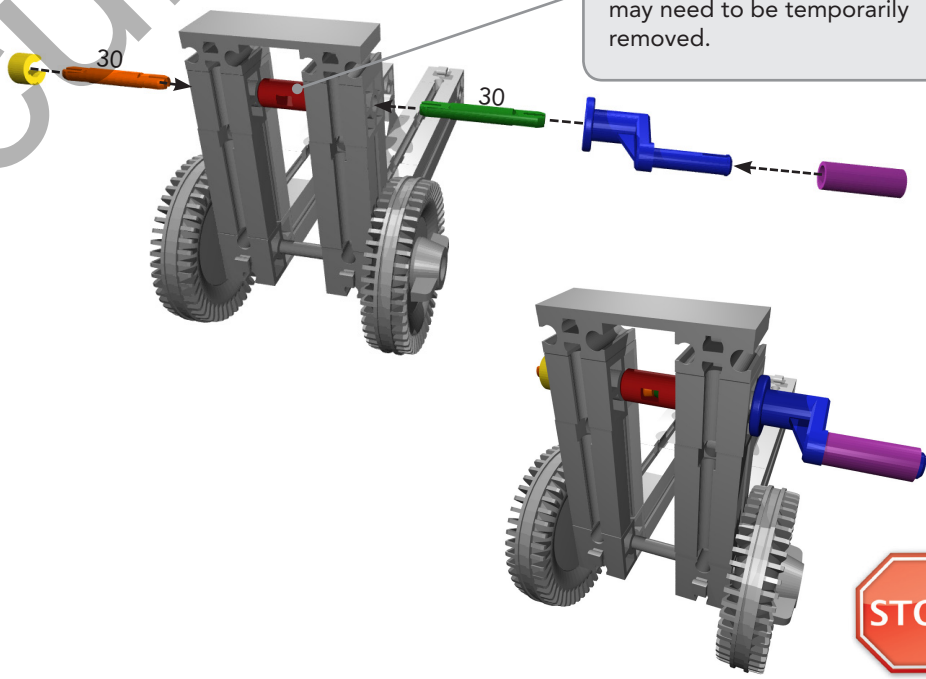

x1

x2


x1

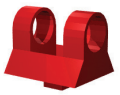

x1


x1

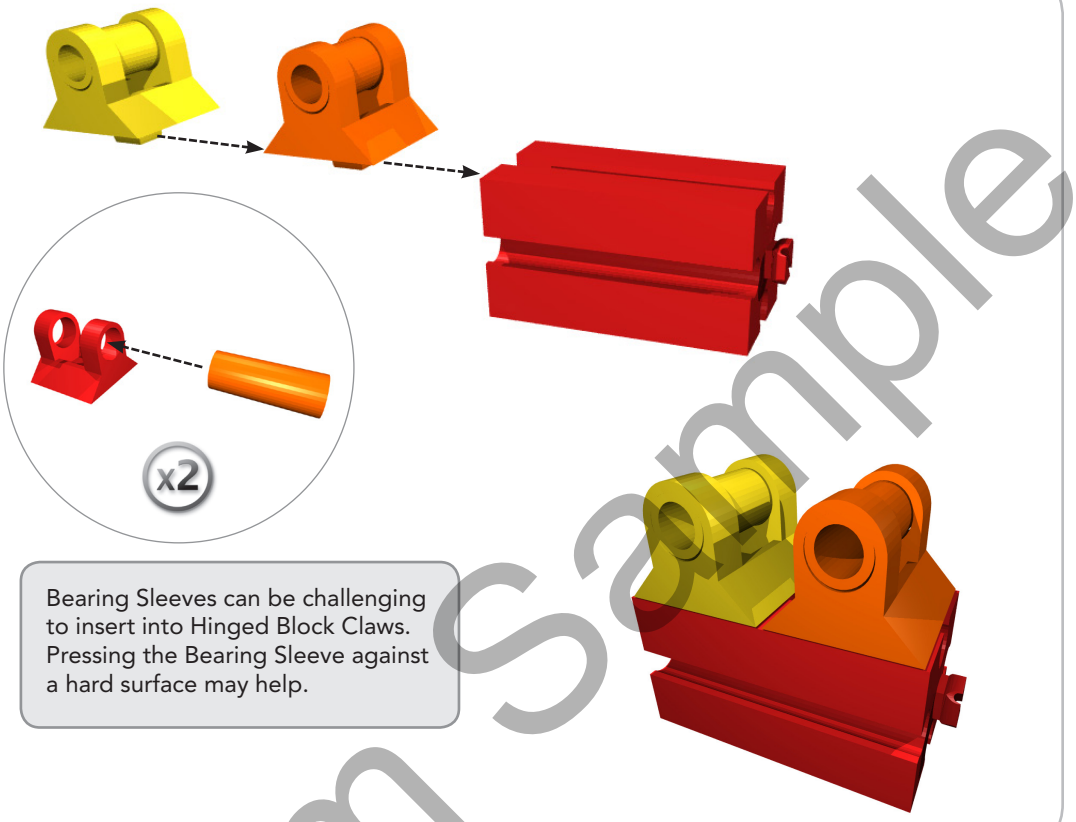


8


x1


x2

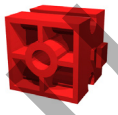

x2

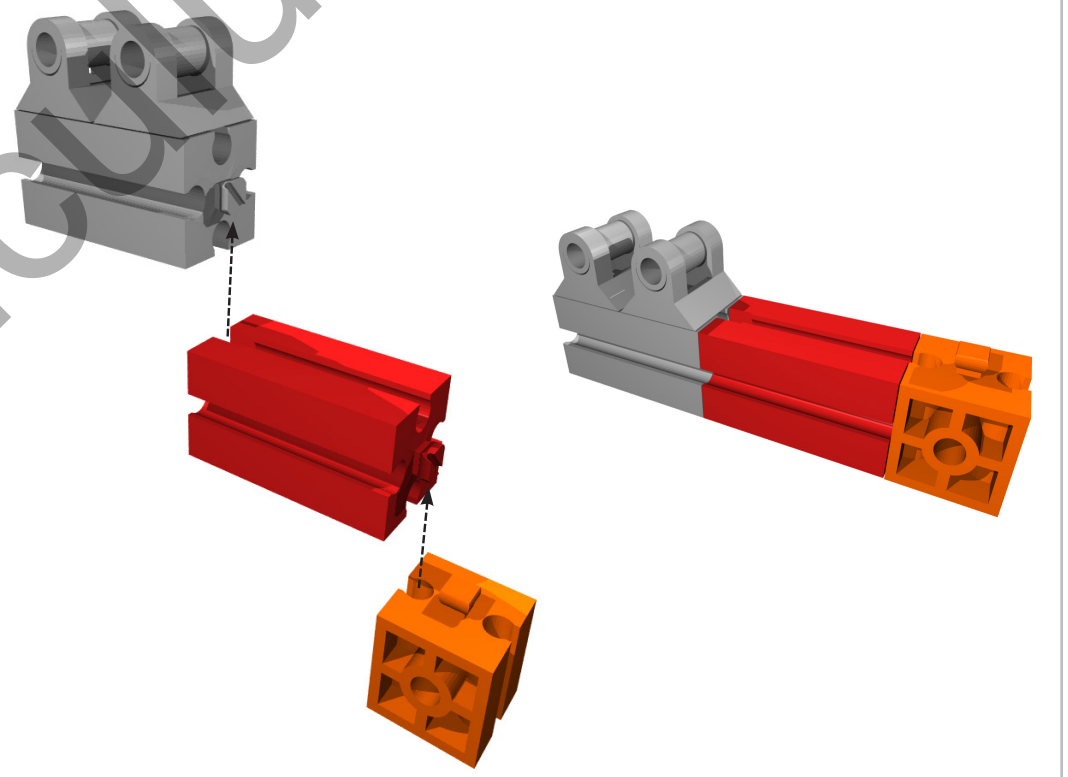


Bearing Sleeves can be challenging to insert into Hinged Block Claws. Pressing the Bearing Sleeve against a hard surface may help.

9


x1


x1



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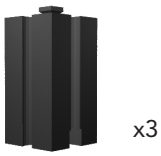

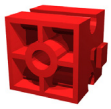

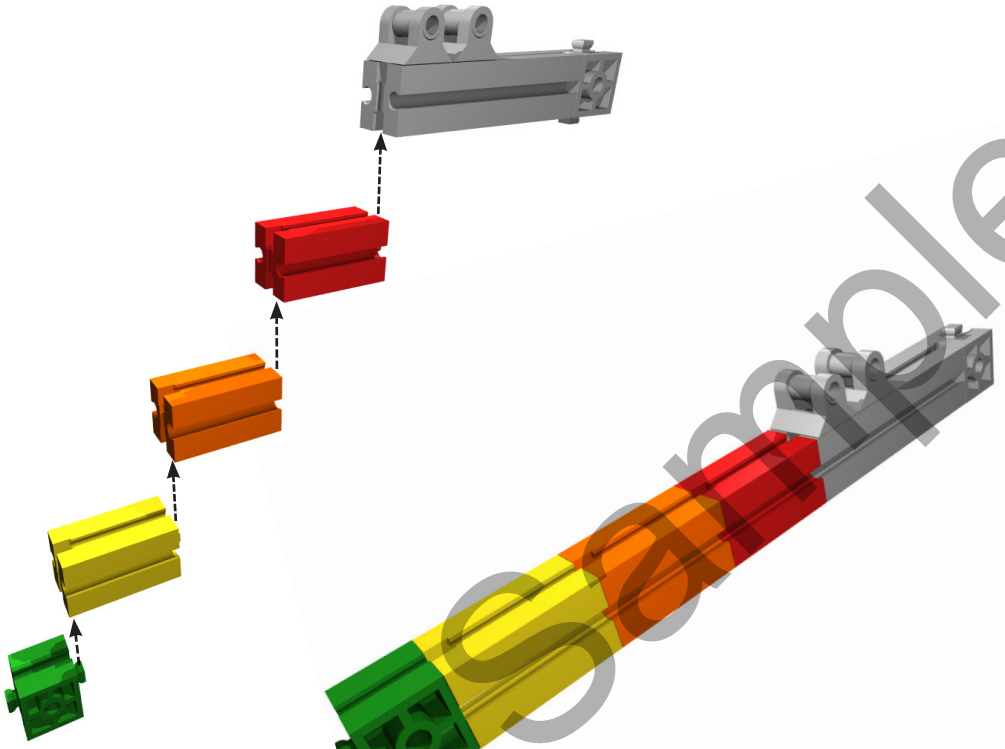

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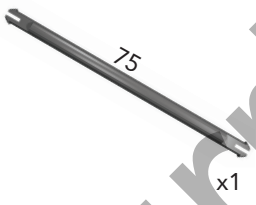
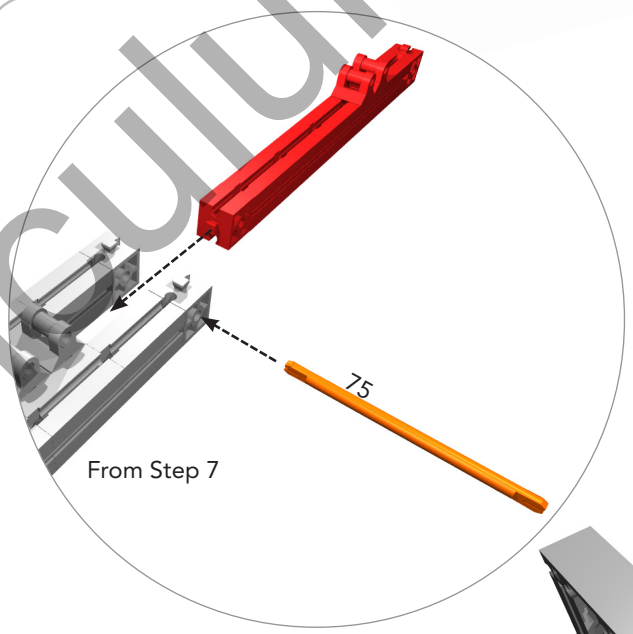
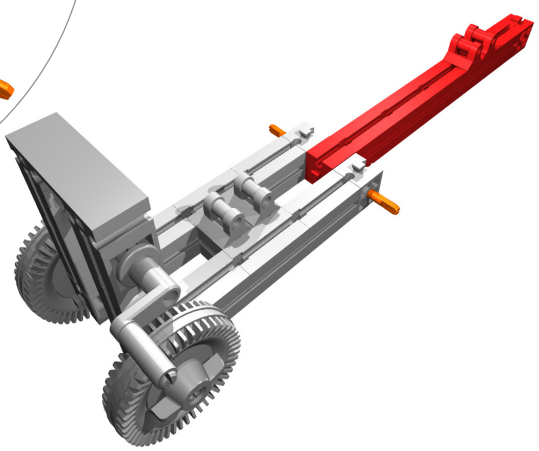
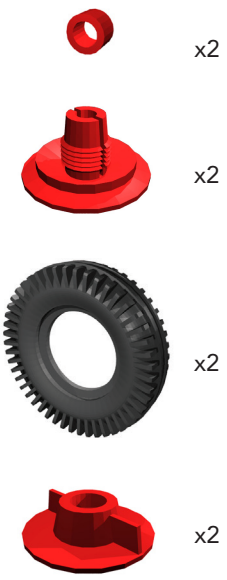
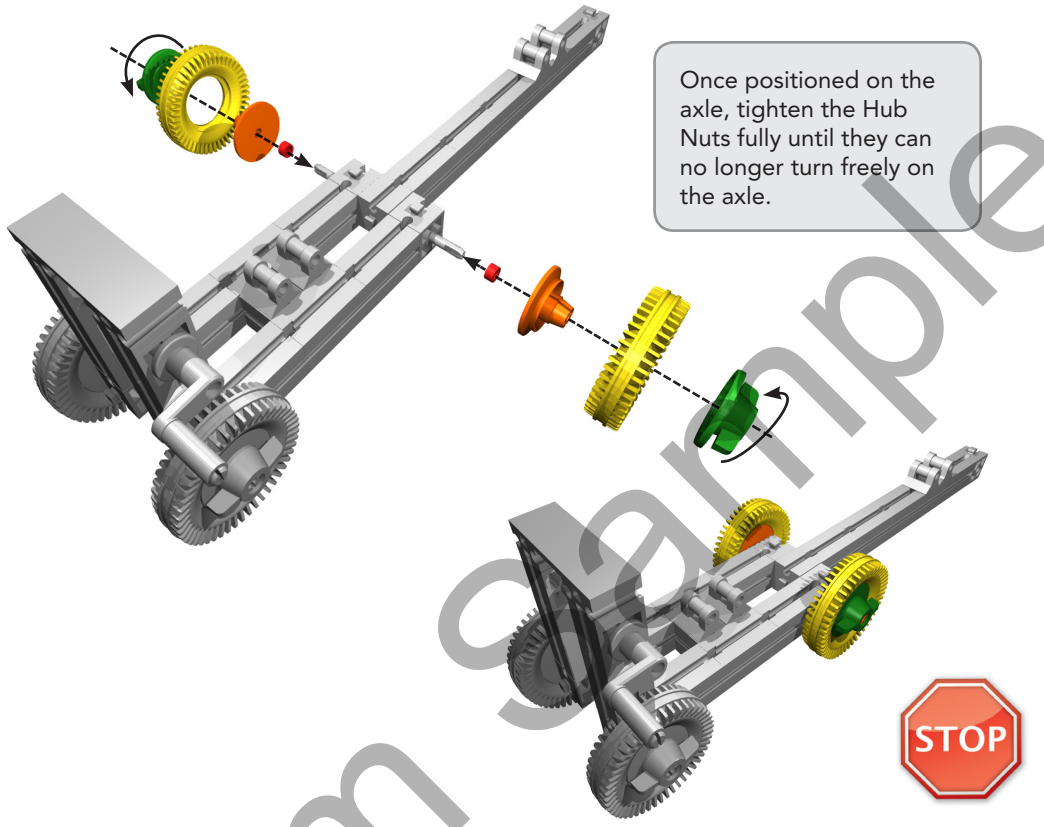






12





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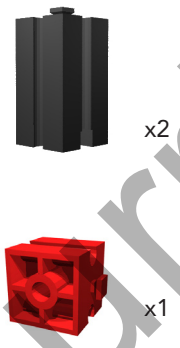
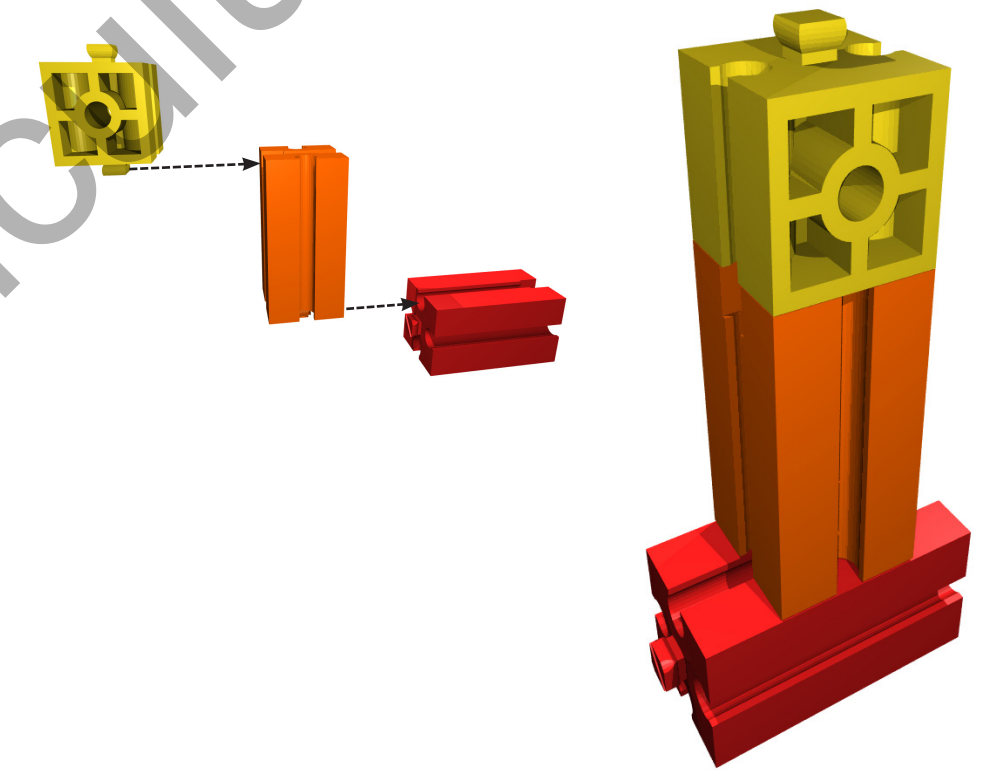
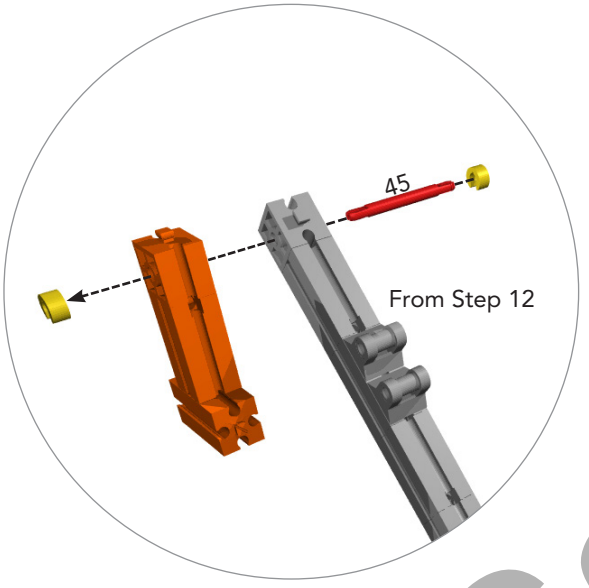




14

x1

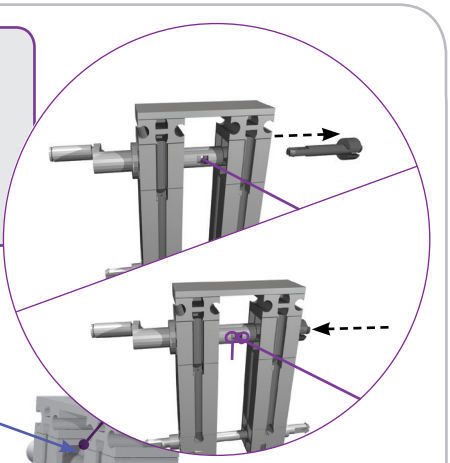
x2

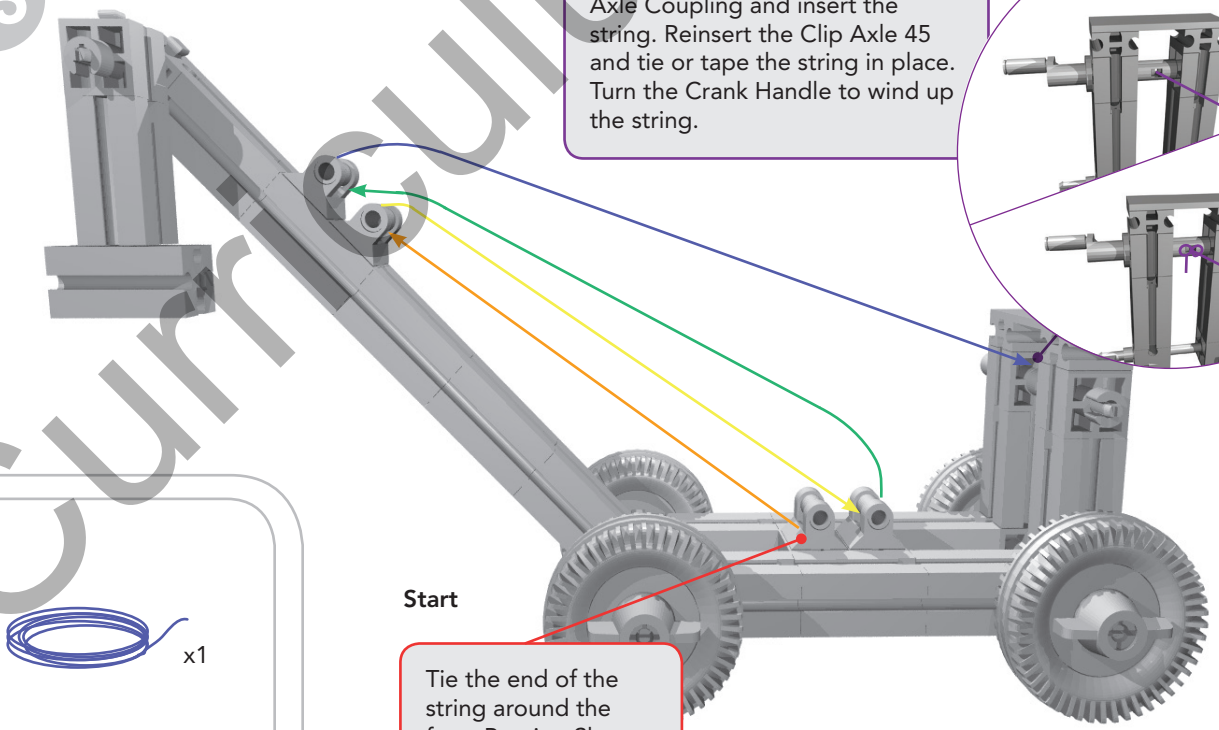


The hook assembly will hang freely.

15

Pull the Clip Axle 45 out of the Axle Coupling and insert the string. Reinsert the Clip Axle 45 and tie or tape the string in place. Turn the Crank Handle to wind up the string.





Start

Tie the end of the string around the front Bearing Sleeve.

x1

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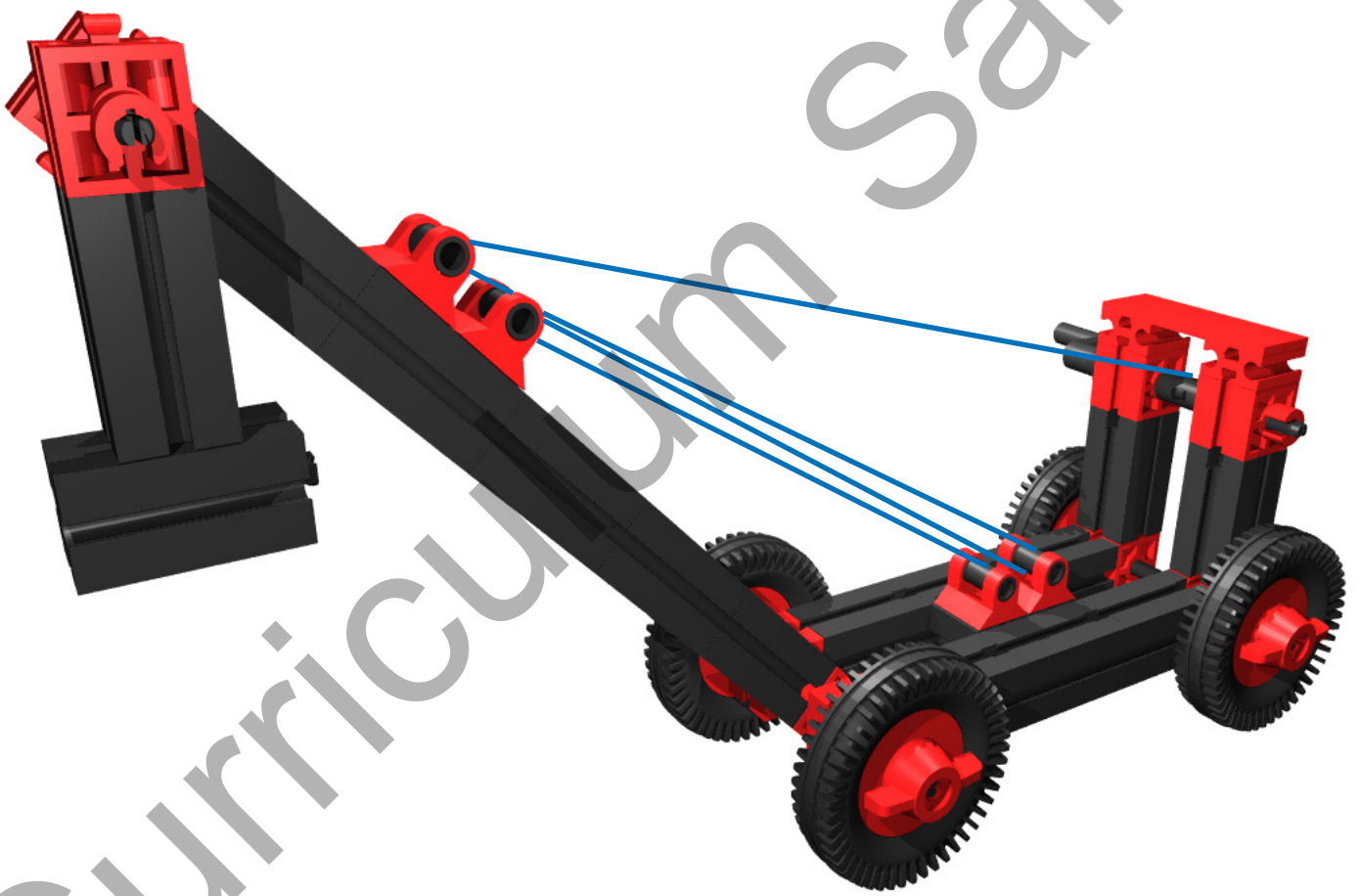
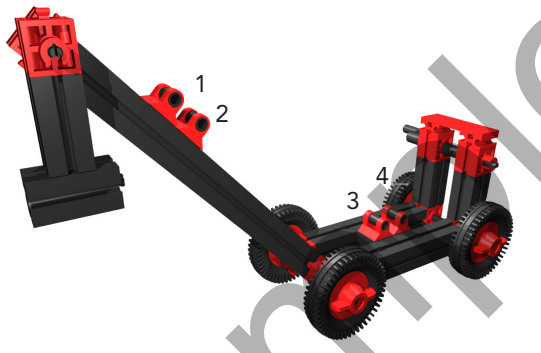
Finished Model

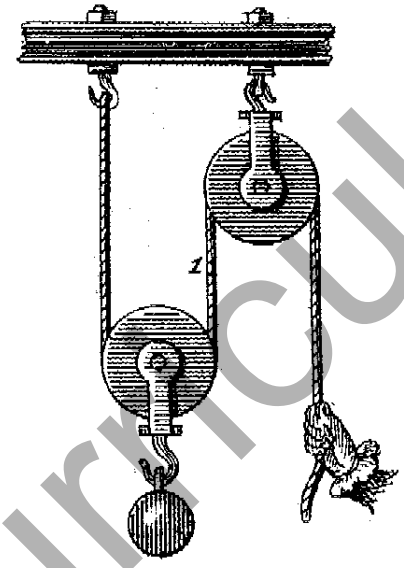


Engineering

A pulley is a simple machine made with a rope or belt wrapped around a grooved wheel. Pulleys are generally used to raise, lower, or move a load. A single pulley only changes the direction of the applied force relative to the load, but the effort required to move the load remains the same. There are four pulleys incorporated in the crane model.



The fischertechnik® crane has three working pulleys. (The fourth pulley is used to anchor the string and isn't classified as a working pulley.) Because the model uses three working pulleys of the same size, the effort required is one-third of what is required if no pulleys are used.



Multiple Pulleys

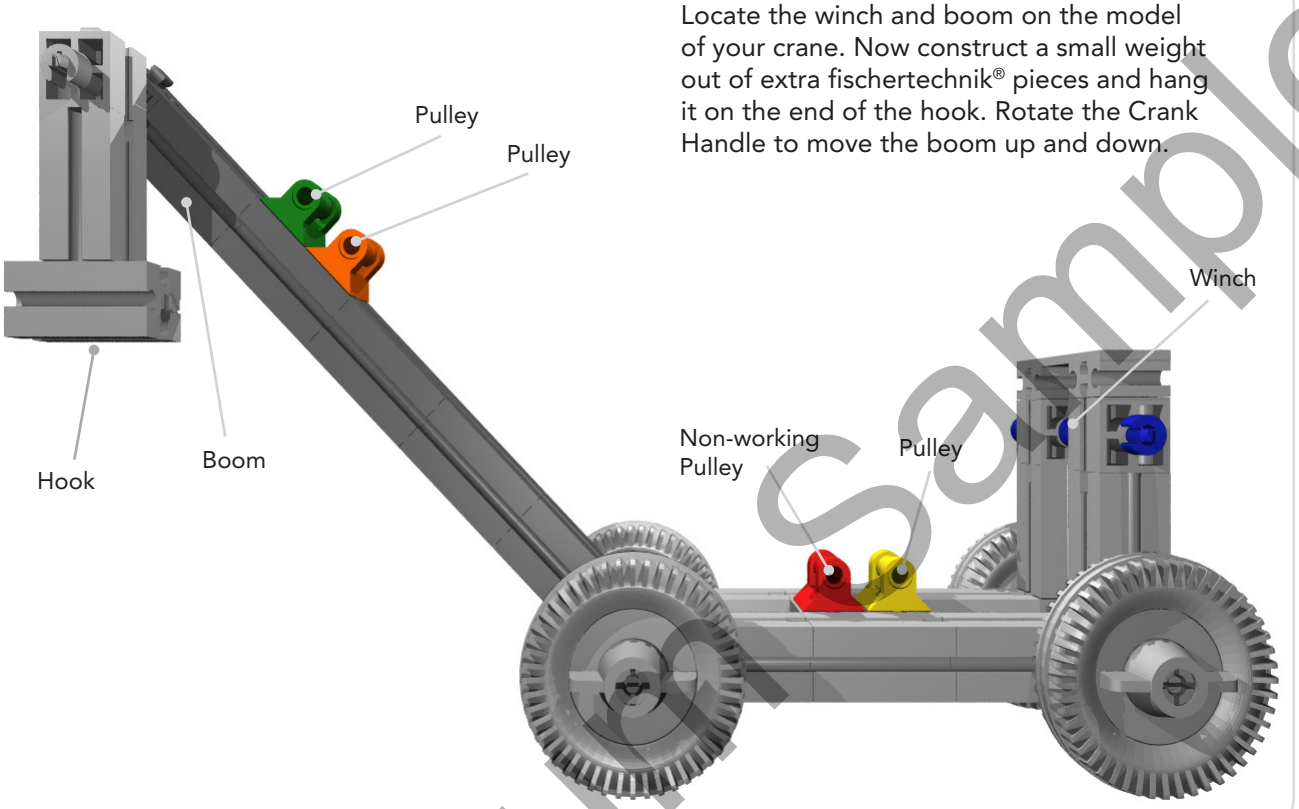
Several pulleys are often used together to reduce the amount of force needed to move a load, as in the crane model. For example, a double pulley system using two working pulleys of the same size would allow an operator to lift a load using half the effort that would be required using a single pulley.

How has it changed the world?

Reflect on how to build anything on a large scale. Large stone blocks or other building materials are lifted using cranes to construct today's impressive skyscrapers, such as the Burj Khalifa in Dubai, which stands at 160 stories high.

Even in ancient times the use of pulley systems on ships allowed heavy cargo to be lifted, moved, and transported to other countries. This same use applies to loading freight train cars, freight trucks, and large ships. Other pulley systems include a conveyor belt, car engine, flag pole, and block and tackle.

Try This



Locate the winch and boom on the model of your crane. Now construct a small weight out of extra fischertechnik® pieces and hang it on the end of the hook. Rotate the Crank Handle to move the boom up and down.

Now, remove the string from the pulleys and attach it directly from the end of the boom to the winch (a mechanical device used to pull or tighten a rope) and repeat the experiment.

1. Which of the two experiments is easier? Why?

2. How could you add more pulleys? What changes would need to be made to the model?