

CHAPTER 4

NXT AT-ST

Also known as “chicken walker,” because of its shape and walking motion, the All Terrain Scout Transport (AT-ST) is a bipedal war craft employed by the Galactic Imperial Forces in the *Star Wars* saga.

In this chapter, you’ll build the AT-ST biped shown in Figure 4-1, guided by detailed building instructions. You’ll program it to walk around, and by the end of this chapter, you’ll have at your command one of the most famous battle robots in the history of cinema.

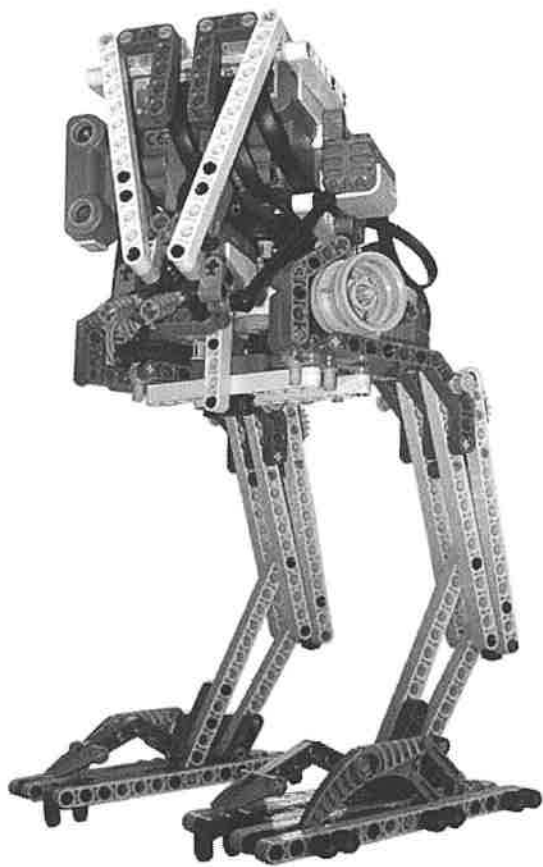
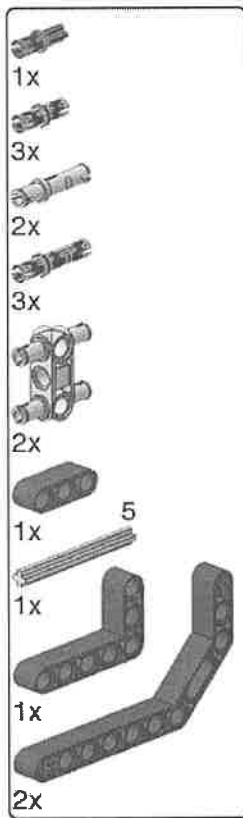


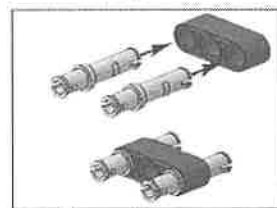
Figure 4-1. *The impressive-looking NXT AT-ST*



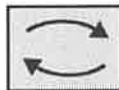
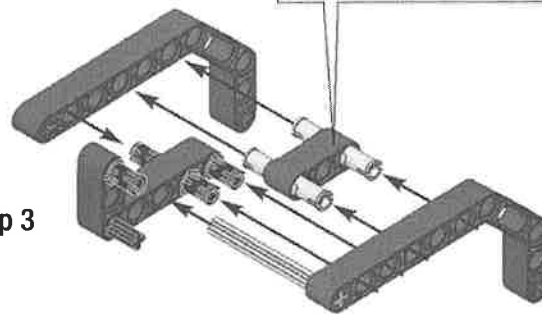
Step 1



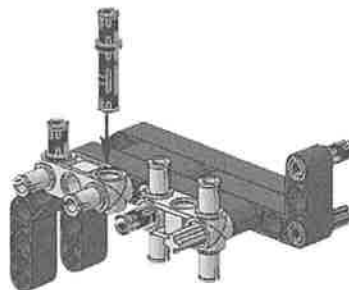
Step 2



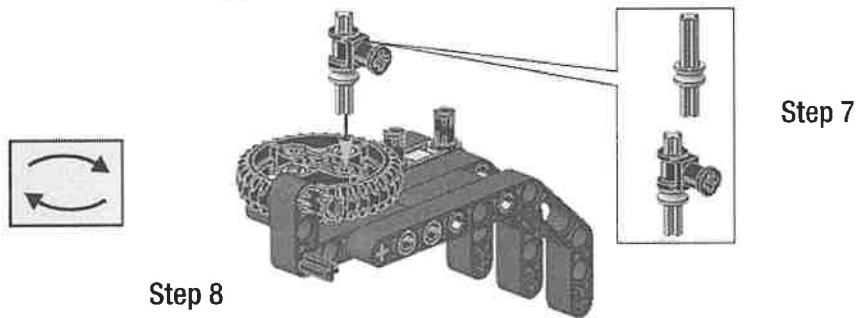
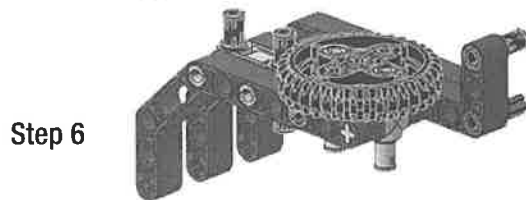
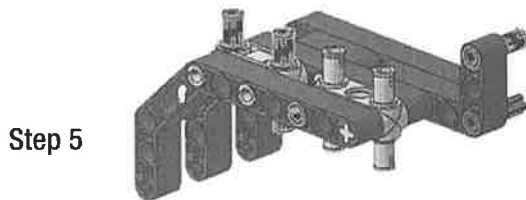
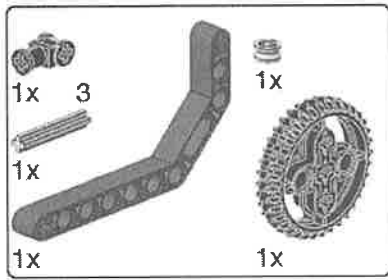
Step 3



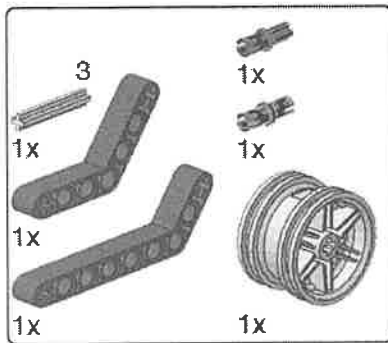
Step 4



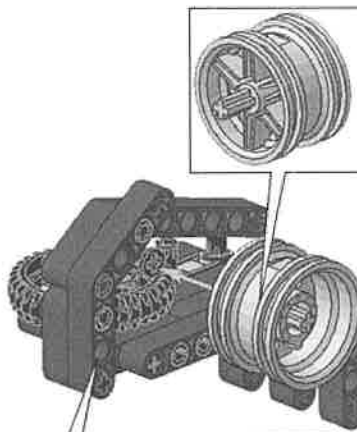
Start building the left hip.



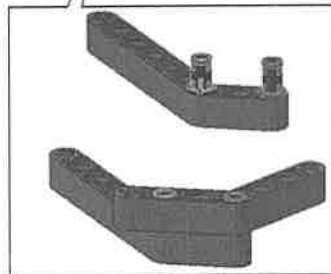
Skip Step 8 if you do not have two black Gears 36 Tooth Double Bevel. Do this to achieve symmetry. In fact, you can't mount the large decorative wheel in the other leg, because that black gear is replaced by two gray belt wheels.



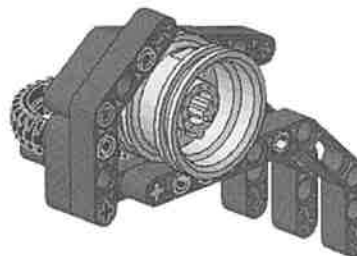
Step 11



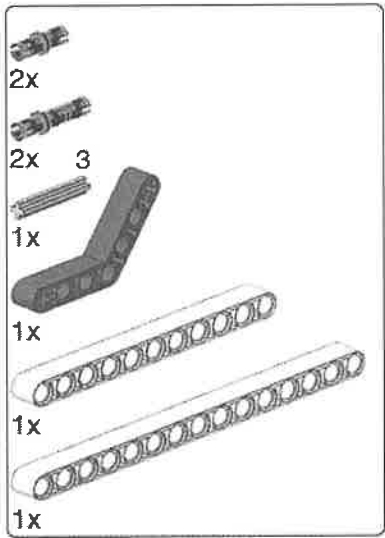
Step 9



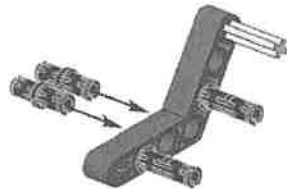
Step 10



Build the decorative parts of the hip. If you don't have two black gears, don't attach the large decorative wheel for the same reason as before.



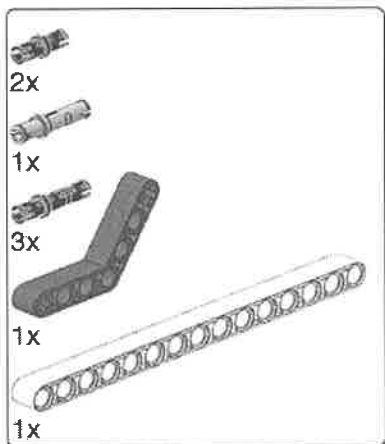
Step 12



Step 13



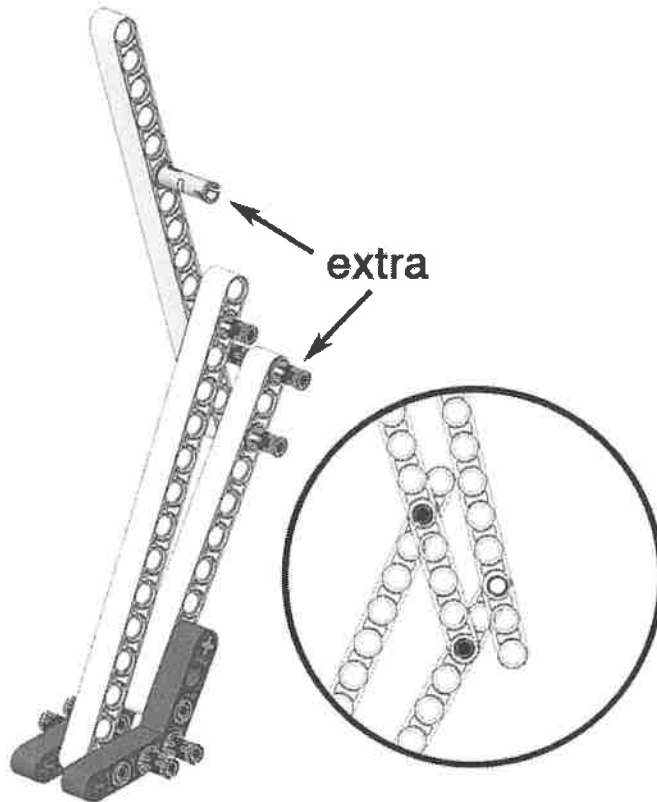
Start building the part of the leg common to both sides.



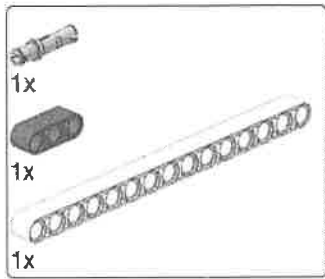
Step 14



Step 15



In Step 15, do not insert the marked pins. In the circle you can see the correct holes in which to attach the upper 15-long beam.



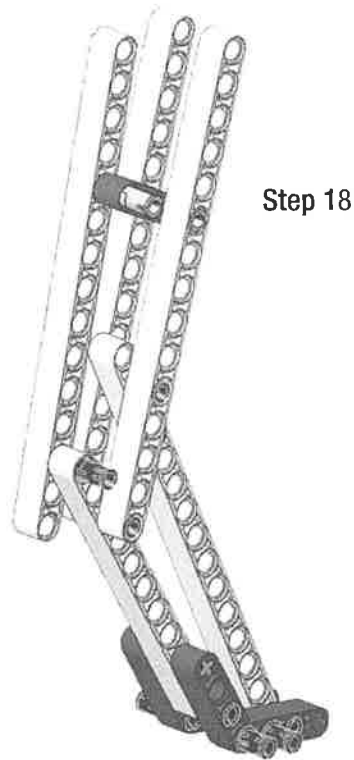
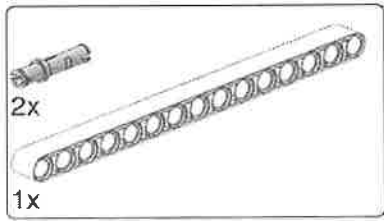
Step 16



Step 17



From here on, you build the decorative part of the leg. If you do not have extra parts, skip Step 16. In Step 17, add just the 15-long beam.

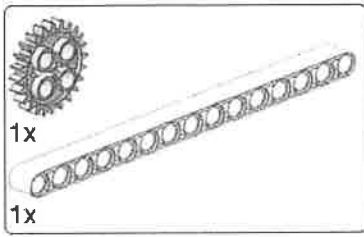


Step 18

Step 19



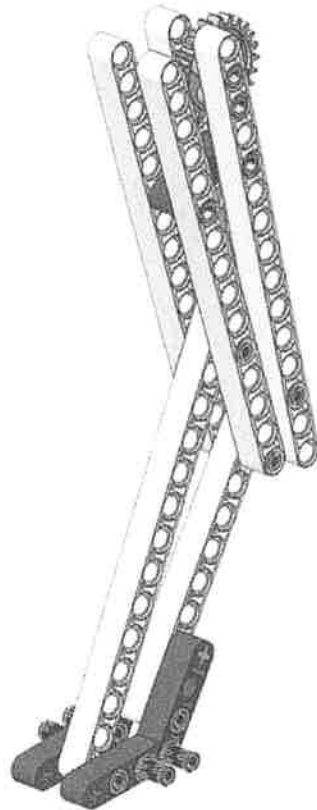
Continue skipping these steps if you don't have the extra parts.



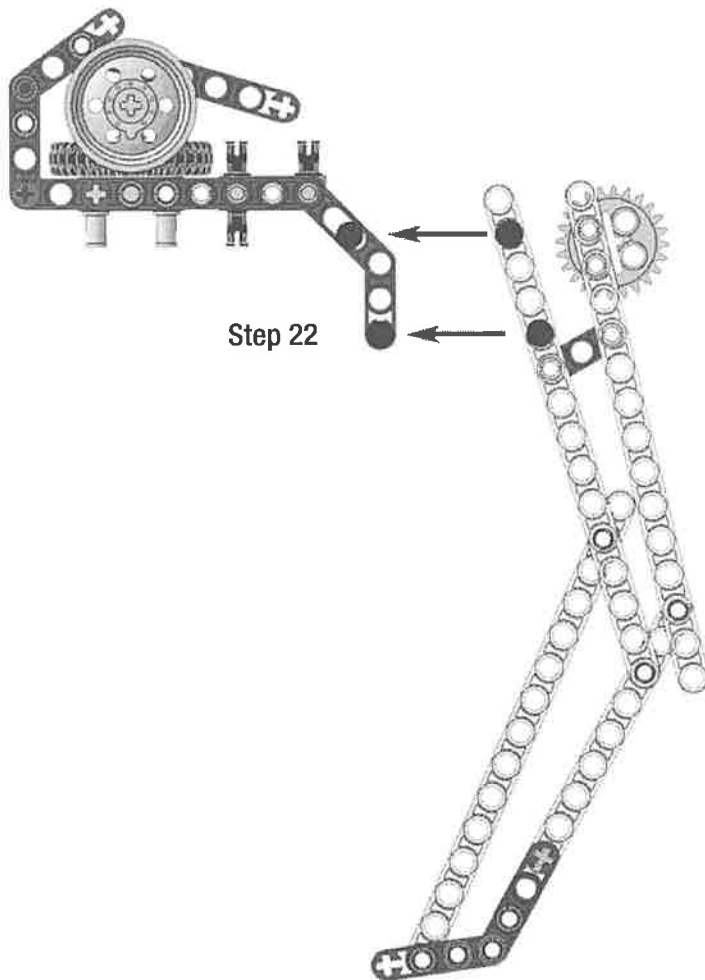
Step 20



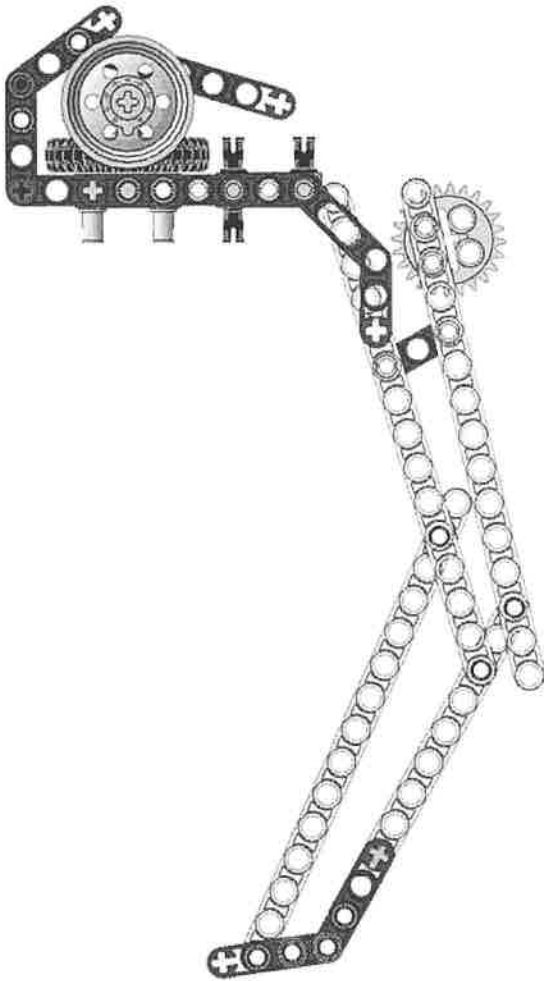
Step 21



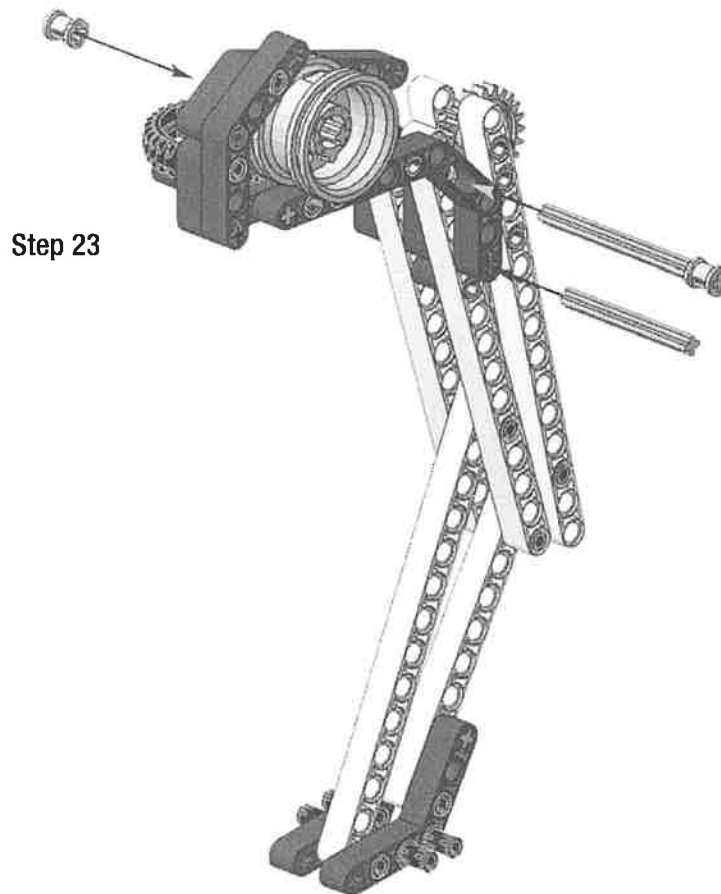
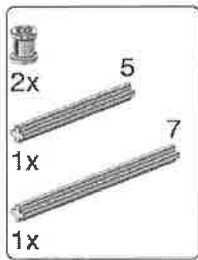
Continue skipping these steps if you don't have the extra parts. The leg is done.



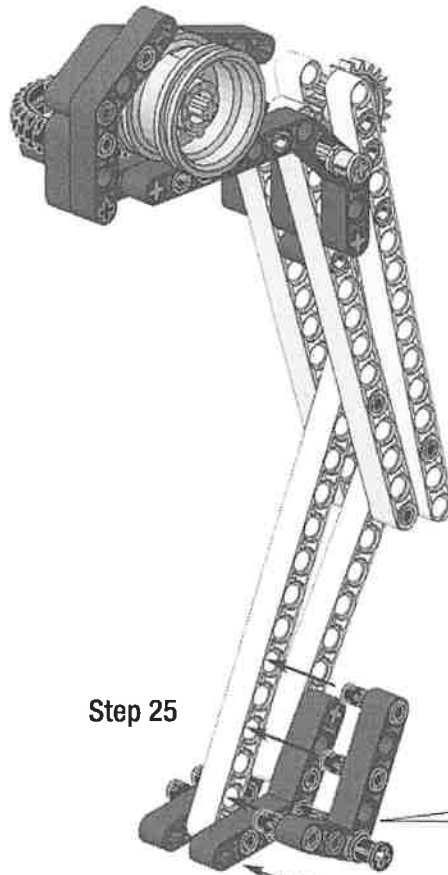
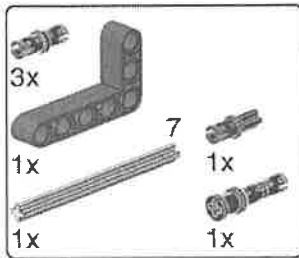
The black spots on the leg must meet the spots on the hip.



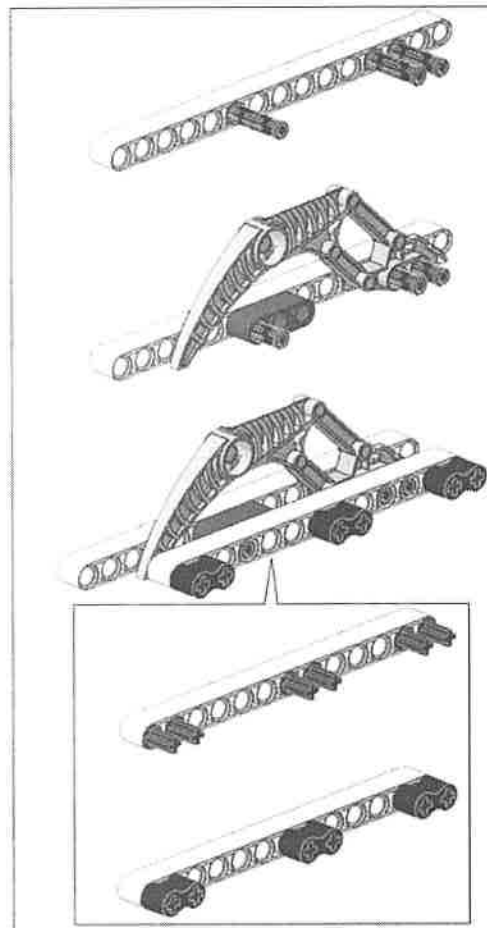
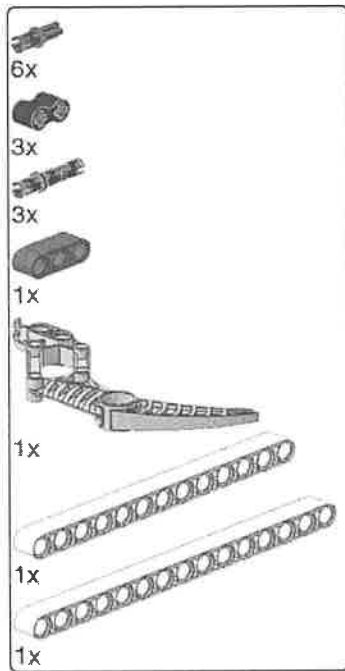
The leg beams must fit in the spaces between the three dark gray bent beams.



This picture shows how the leg should fit in the hip assembly. Insert the axles to hold the leg in place.



Build the reinforcer that prevents the ankle from bending to the outside too much during stepping. Insert the 7-long axle at the end of the leg.



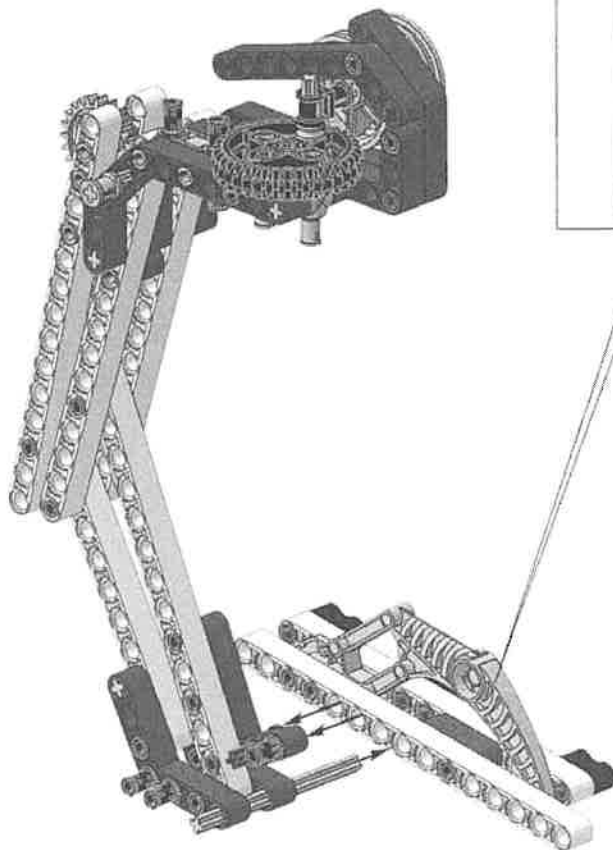
Step 27

Step 28

Step 31

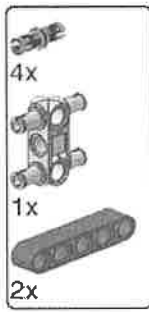
Step 29

Step 30



Step 32

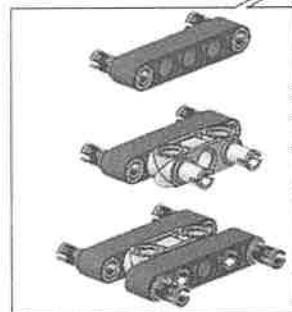
Rotate the assembly and build the external foot.



Step 33

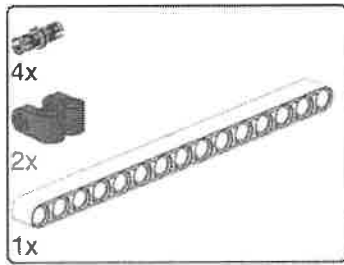
Step 34

Step 35

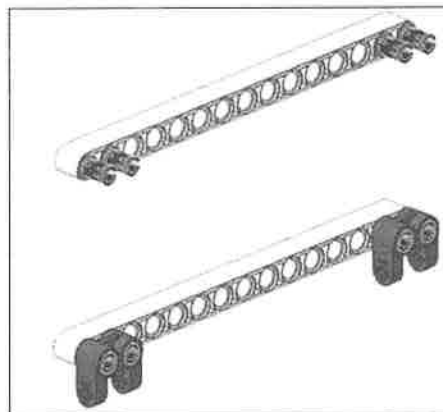


Step 36

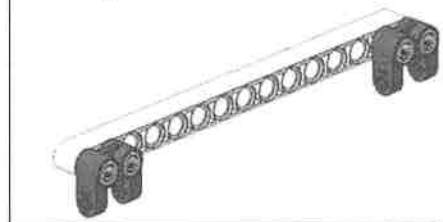
Insert the foot pad.



Step 37

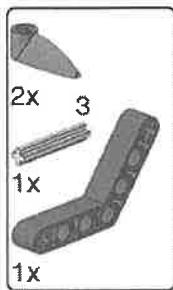


Step 38



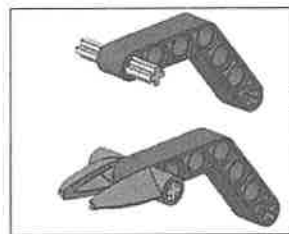
Step 39

Build the internal side of the foot with wedges.



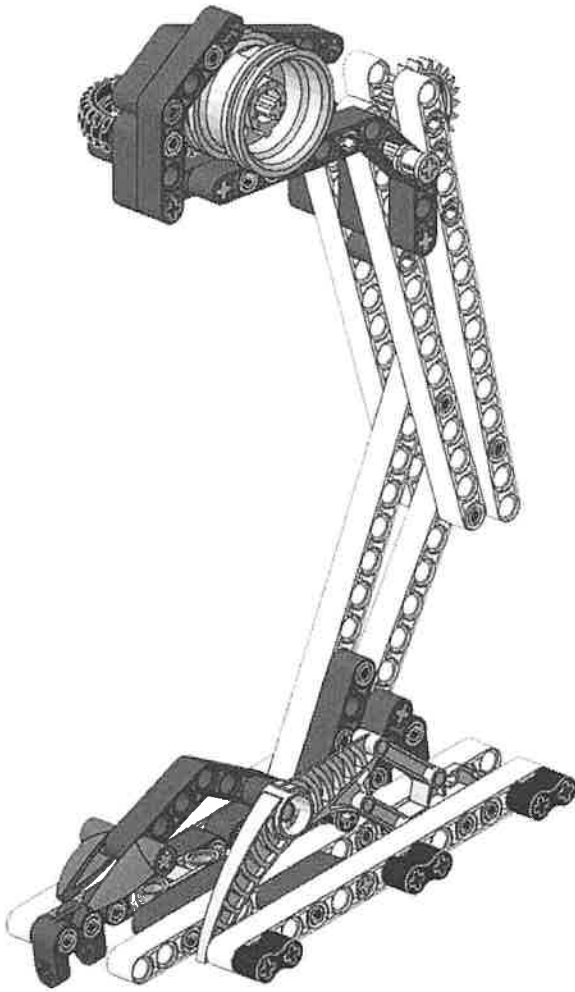
Step 40

Step 41

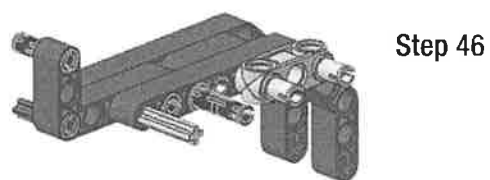
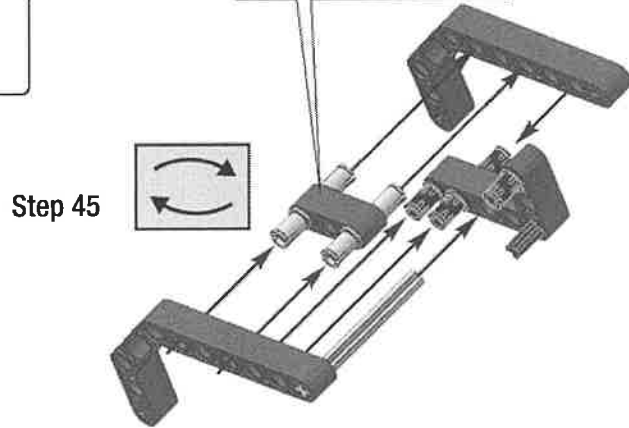
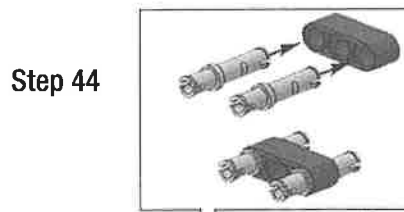
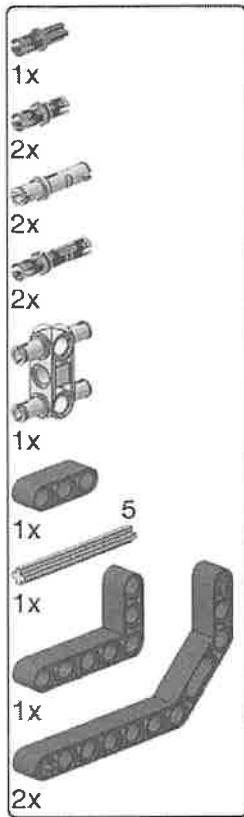


Step 42

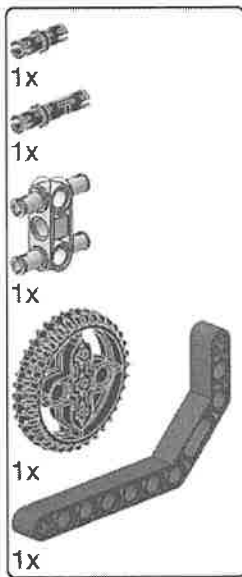
Attach the foot blades.



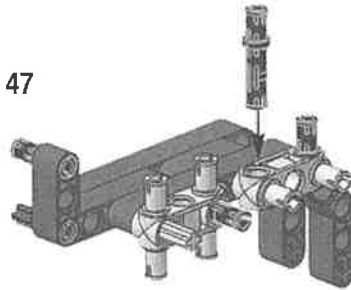
The left leg is completed.



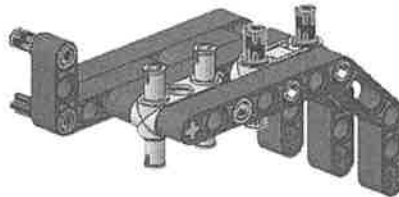
Start building the right hip.



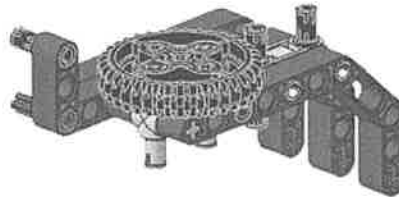
Step 47




Step 48

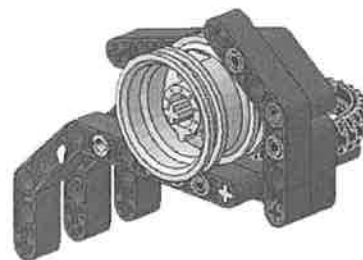
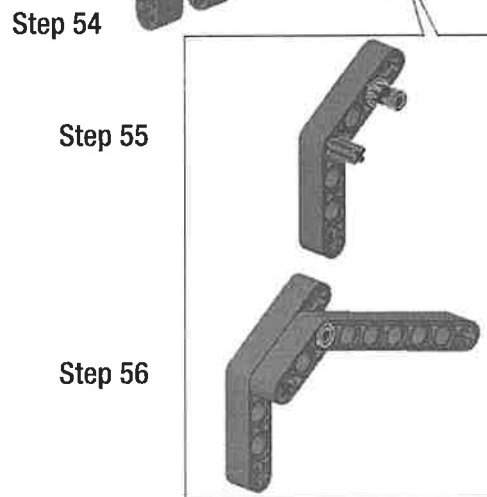
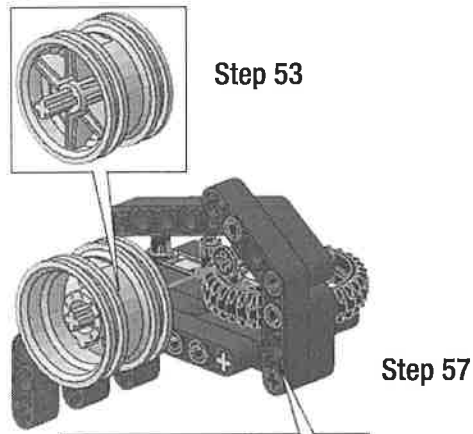
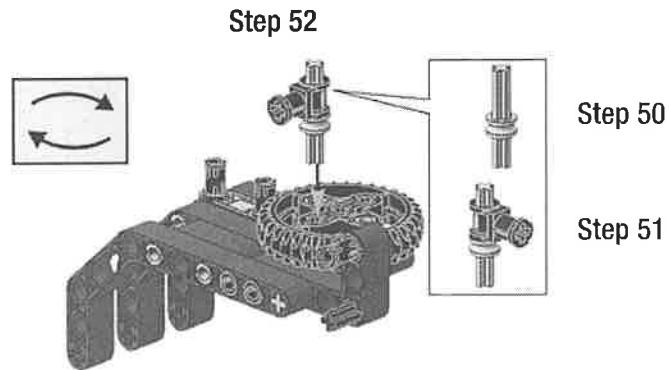
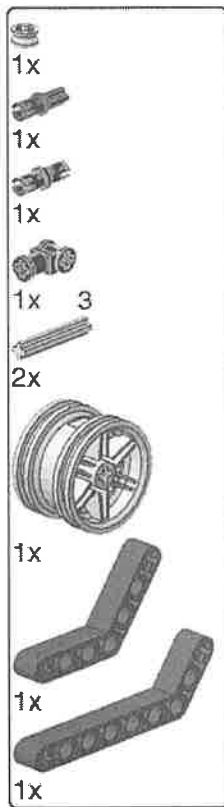


Step 49

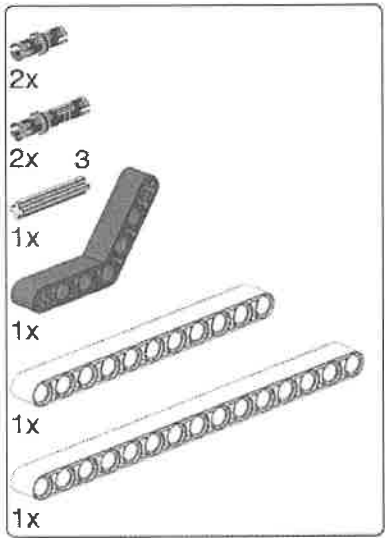


Replace  with 
if you have only one 

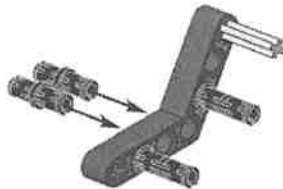
In Step 49, if you don't have the extra black gear, replace the black gear with two gray wheels, checking their position in the figure on page 111.



Build the decorative parts of the hip. Skip Steps 50 to 54 if you replaced the black gear with two gray wheels in Step 49.



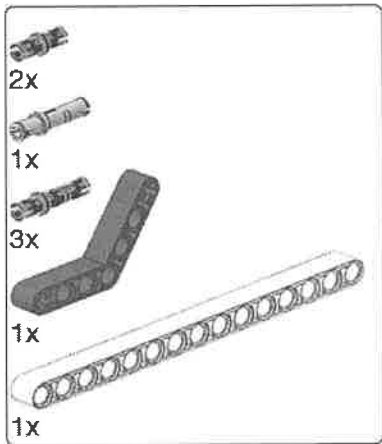
Step 58



Step 59



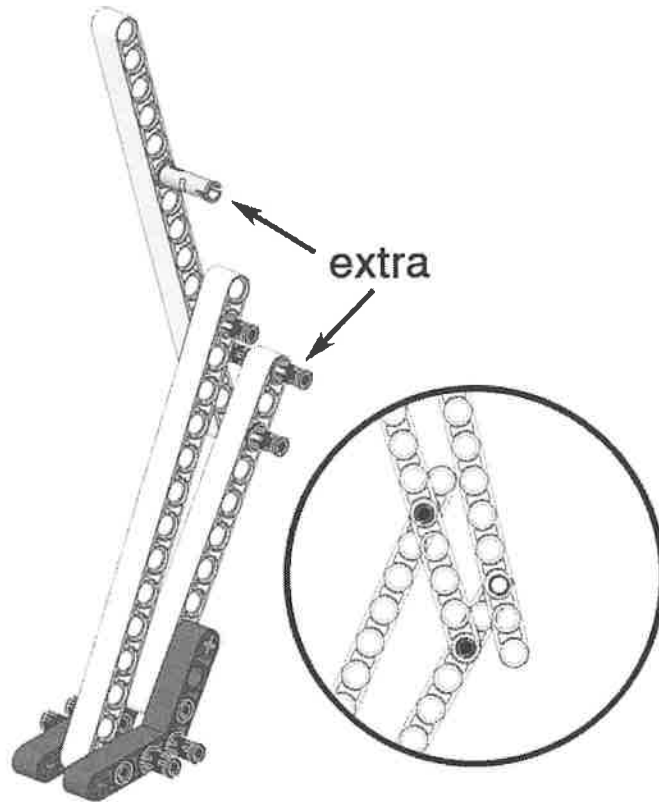
Start building the part of the leg common to both sides.



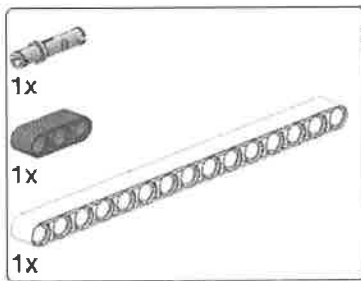
Step 60



Step 61



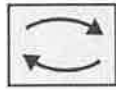
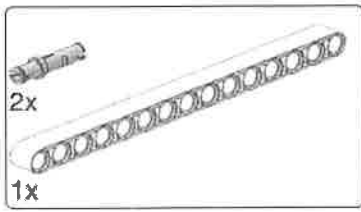
In Step 61, do not insert the marked pins. In the circle you can see the correct holes where you can attach the upper 15-long beam.



Step 62



From now on, you'll build the decorative part of the leg. If you don't have the extra parts, skip Step 62, and in Step 64, add just the 15-long beam.

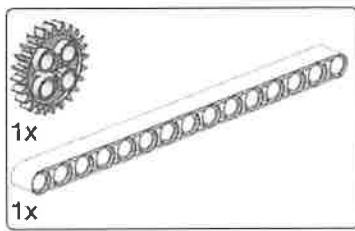
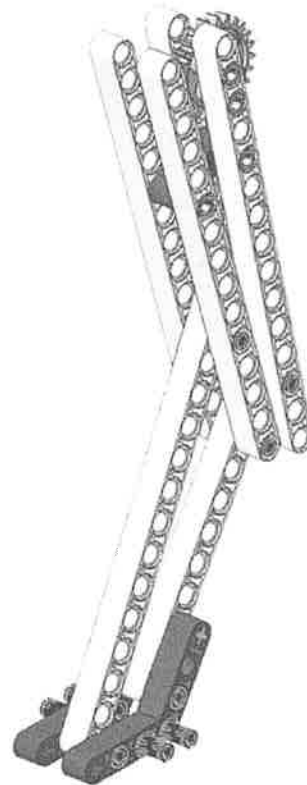


Step 65

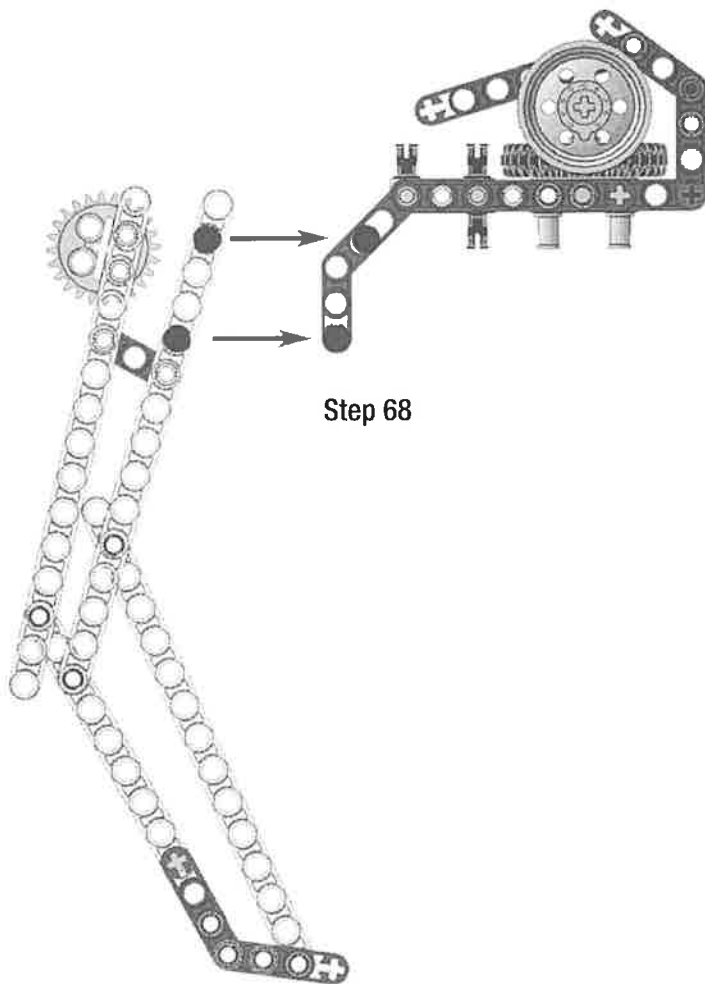


Step 66

Continue skipping these steps if you don't have the extra parts.

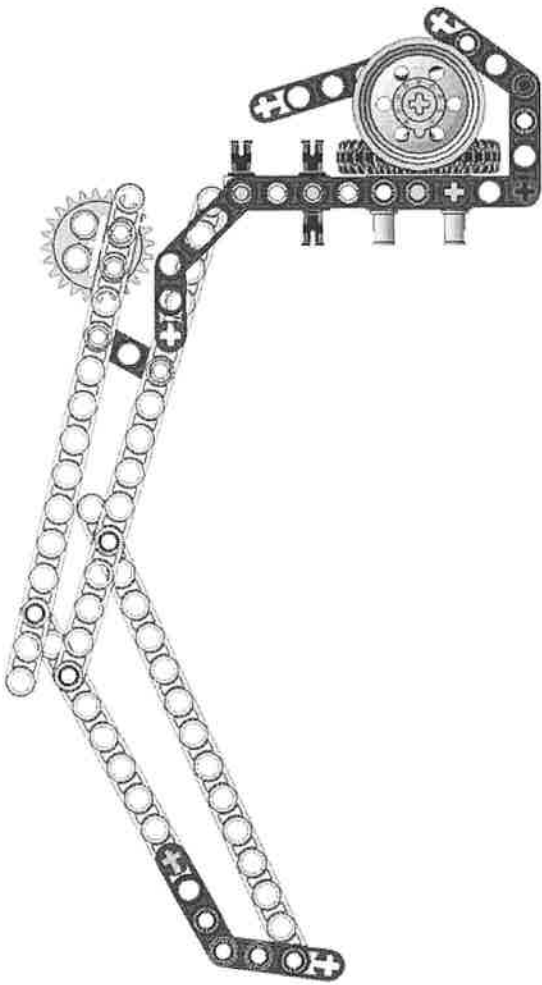
**Step 67**

Continue skipping these steps if you don't have the extra parts. The leg is done.

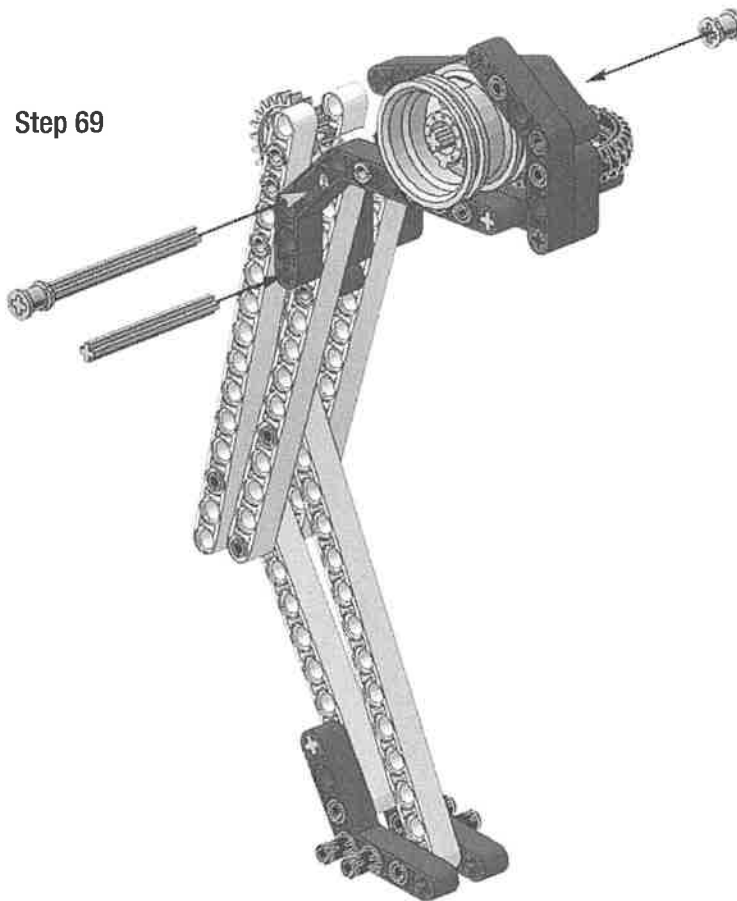
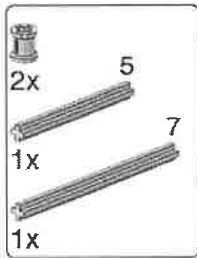


Step 68

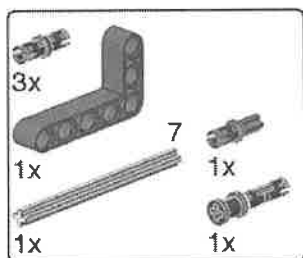
The black spots on the leg must meet the spots on the hip.



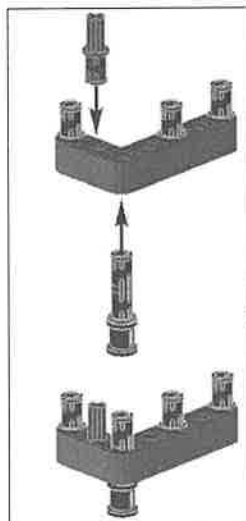
The leg beams must fit in the two spaces between the three dark gray bent beams.



This picture shows how the leg should fit in the hip assembly. Insert the axles to hold the leg in place.



Step 70

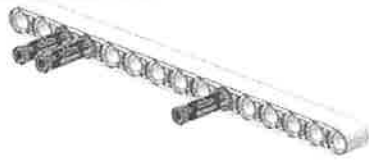


Step 71

Step 72

Build the reinforcer, which prevents the ankle from bending too much to the outside during stepping. Insert the 7-long axle at the end of the leg.

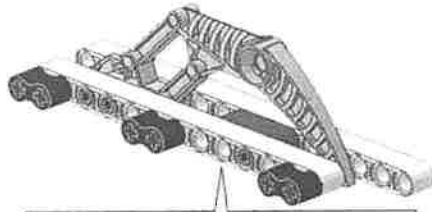
Step 73



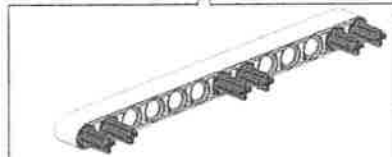
Step 74



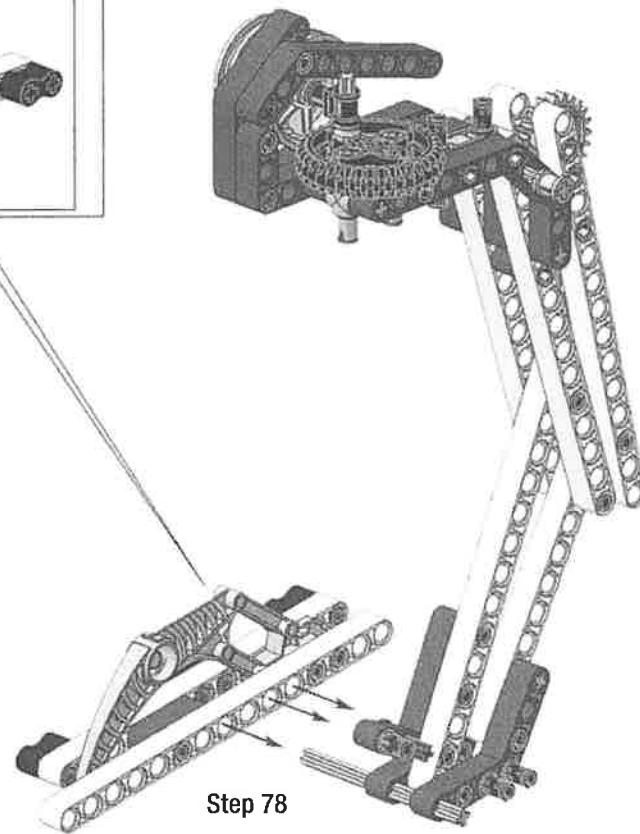
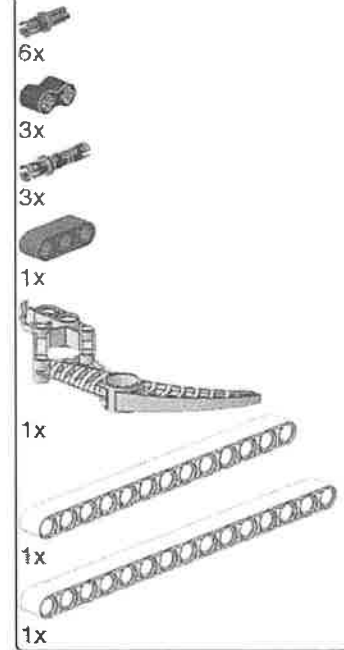
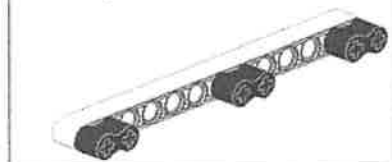
Step 77



Step 75

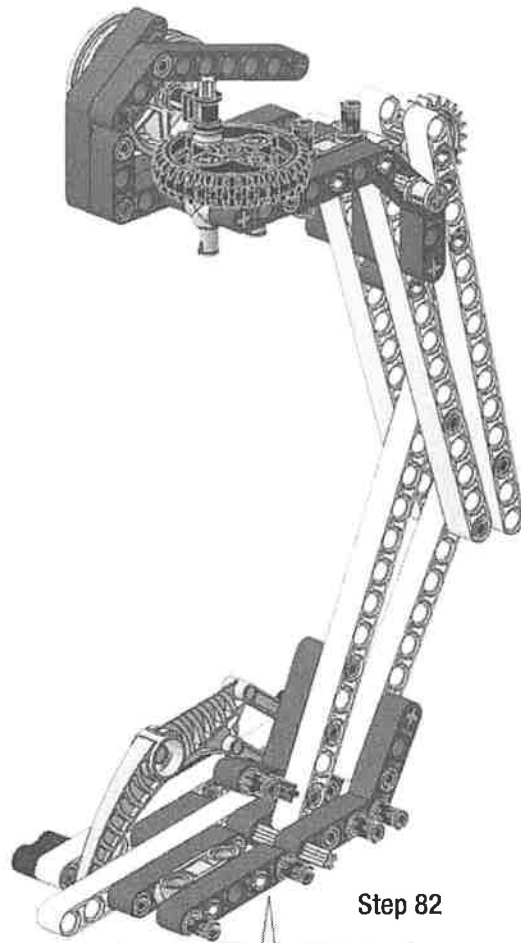
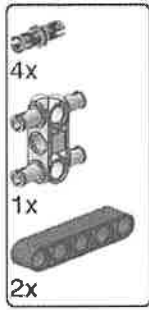


Step 76



Step 78

Rotate the assembly and build the external foot.



Step 82

Step 79



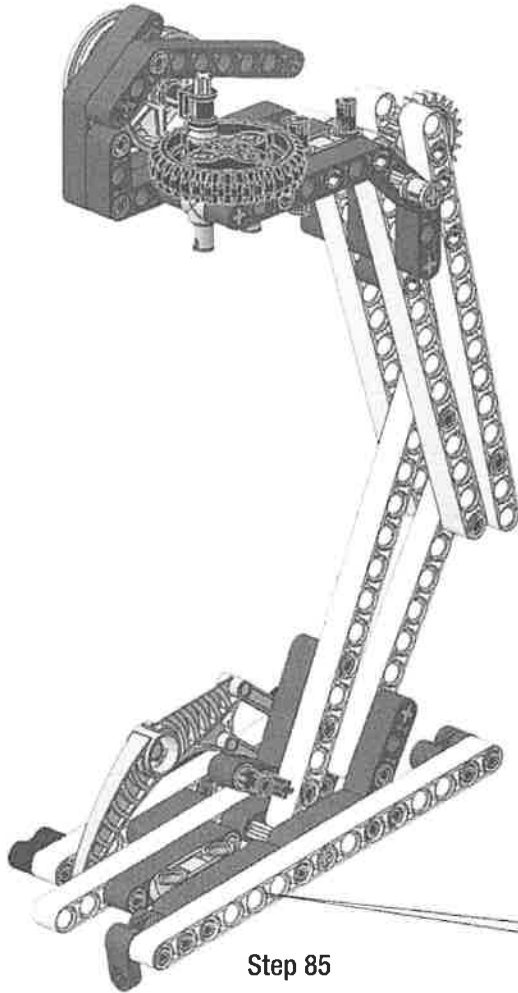
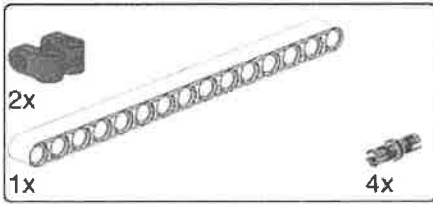
Step 80



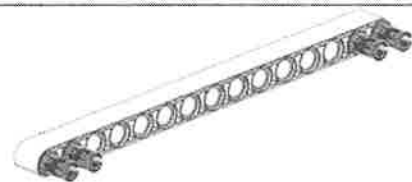
Step 81



Insert the foot pad.



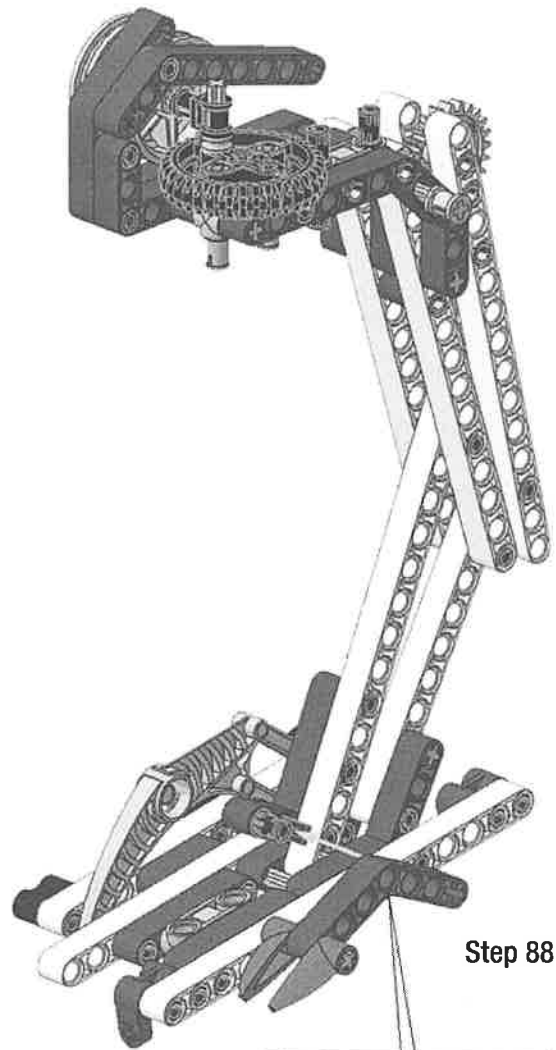
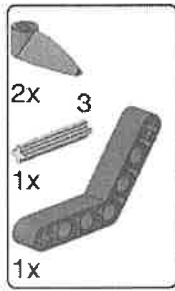
Step 83



Step 84



Build the internal side of the foot with wedges.



Step 86



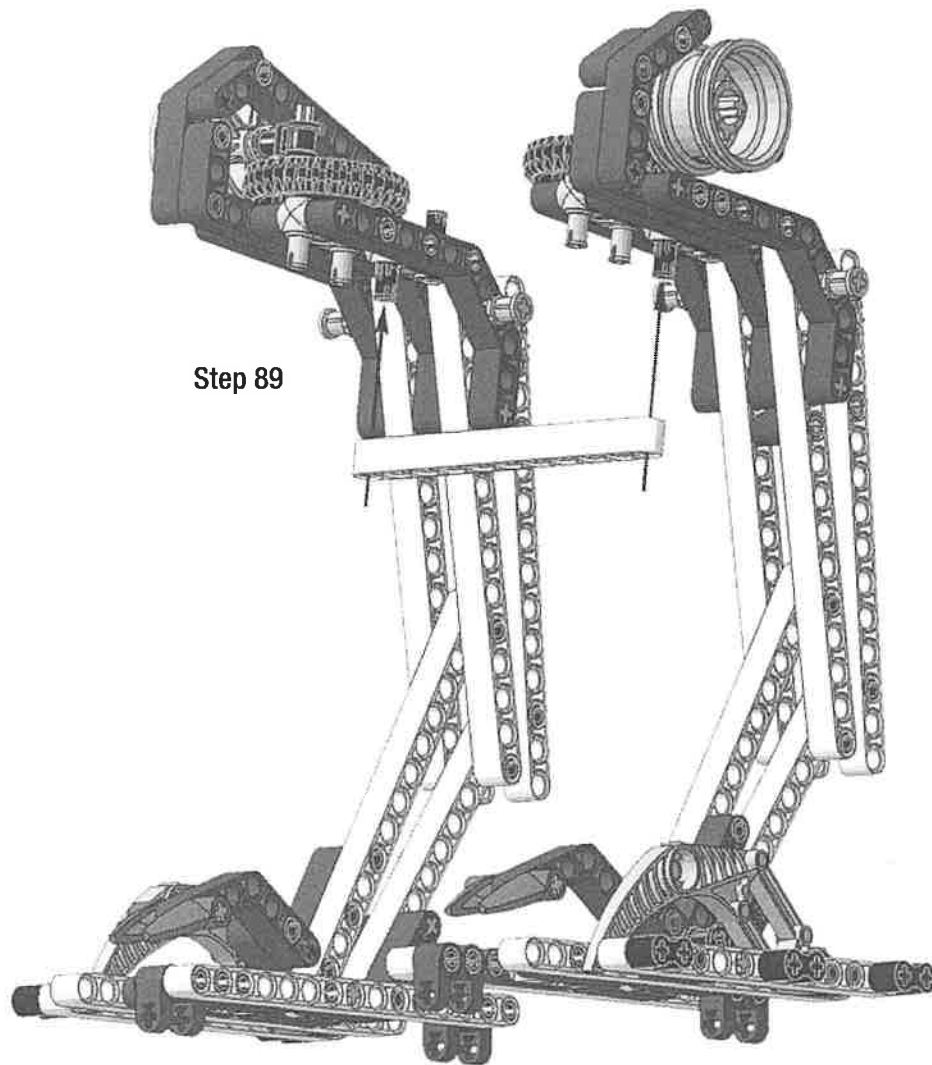
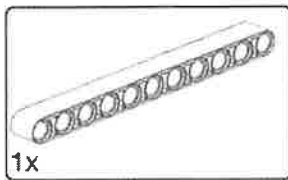
Step 87



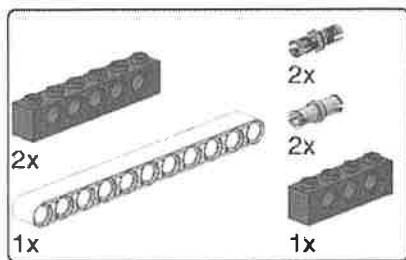
Attach the foot blades.



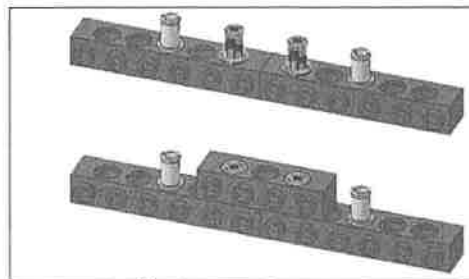
The right leg is completed.



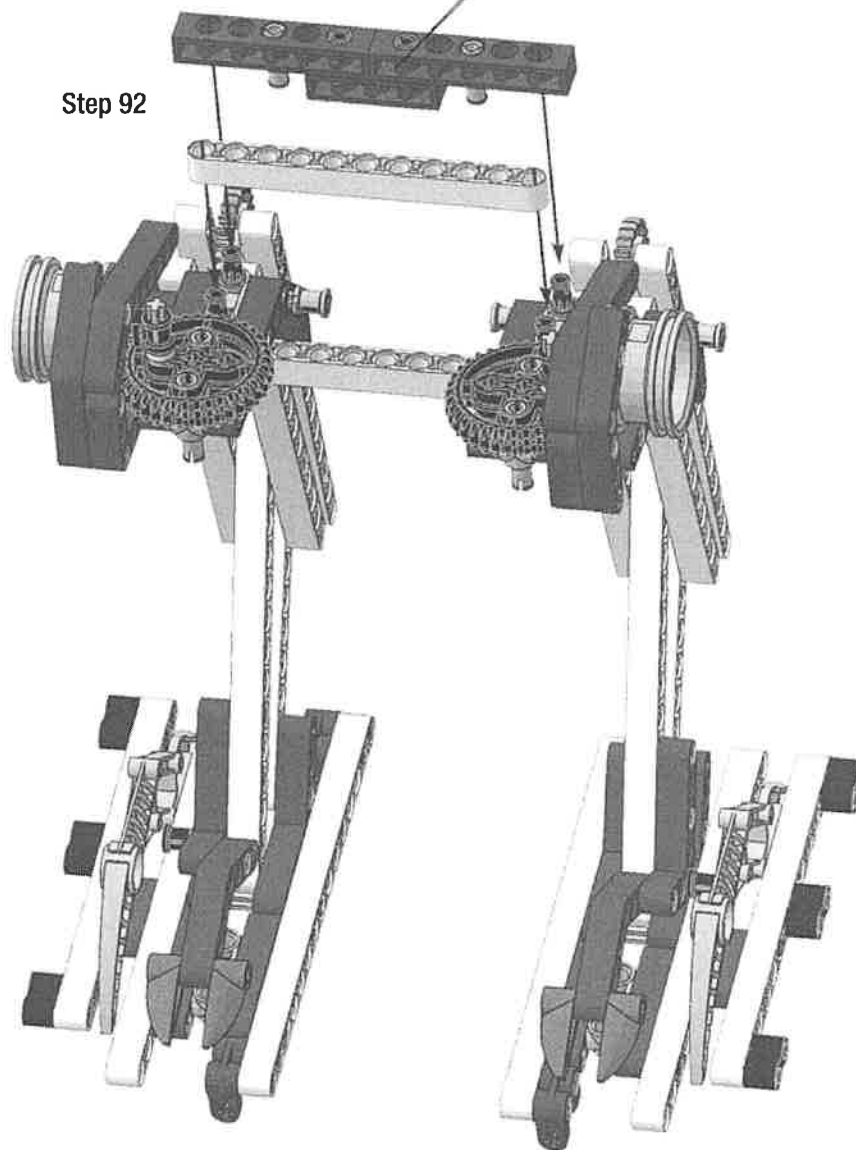
Join the completed legs with an 11-long beam.



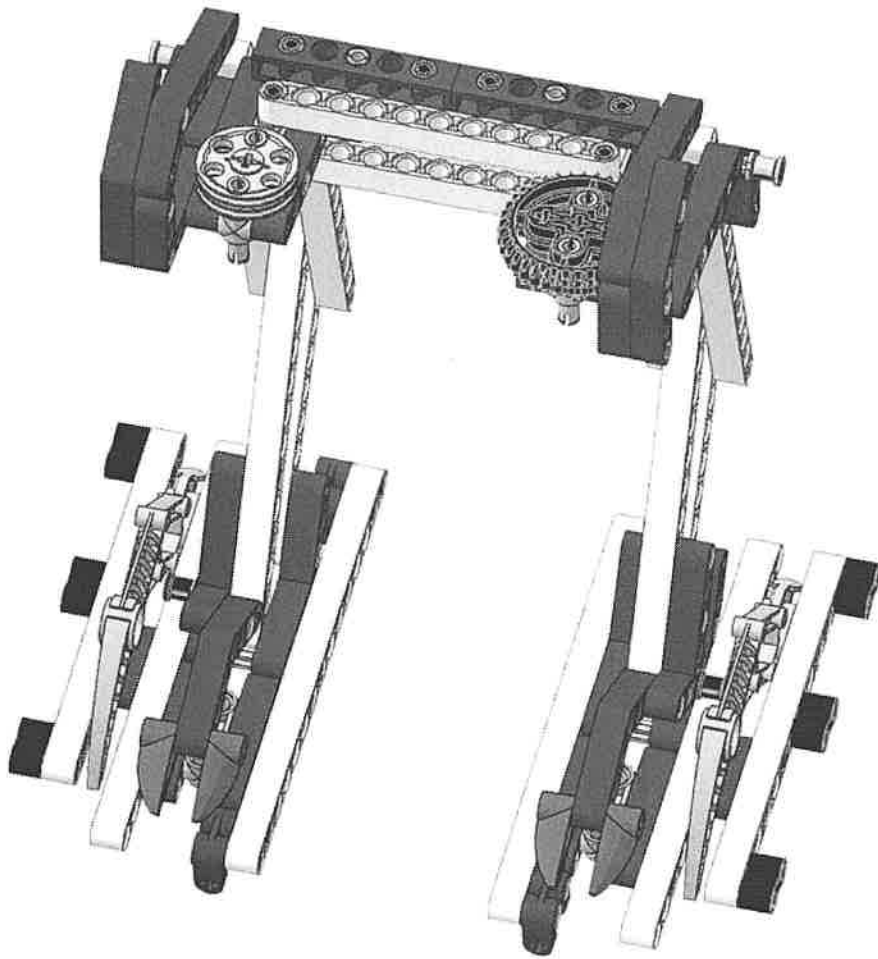
Step 90



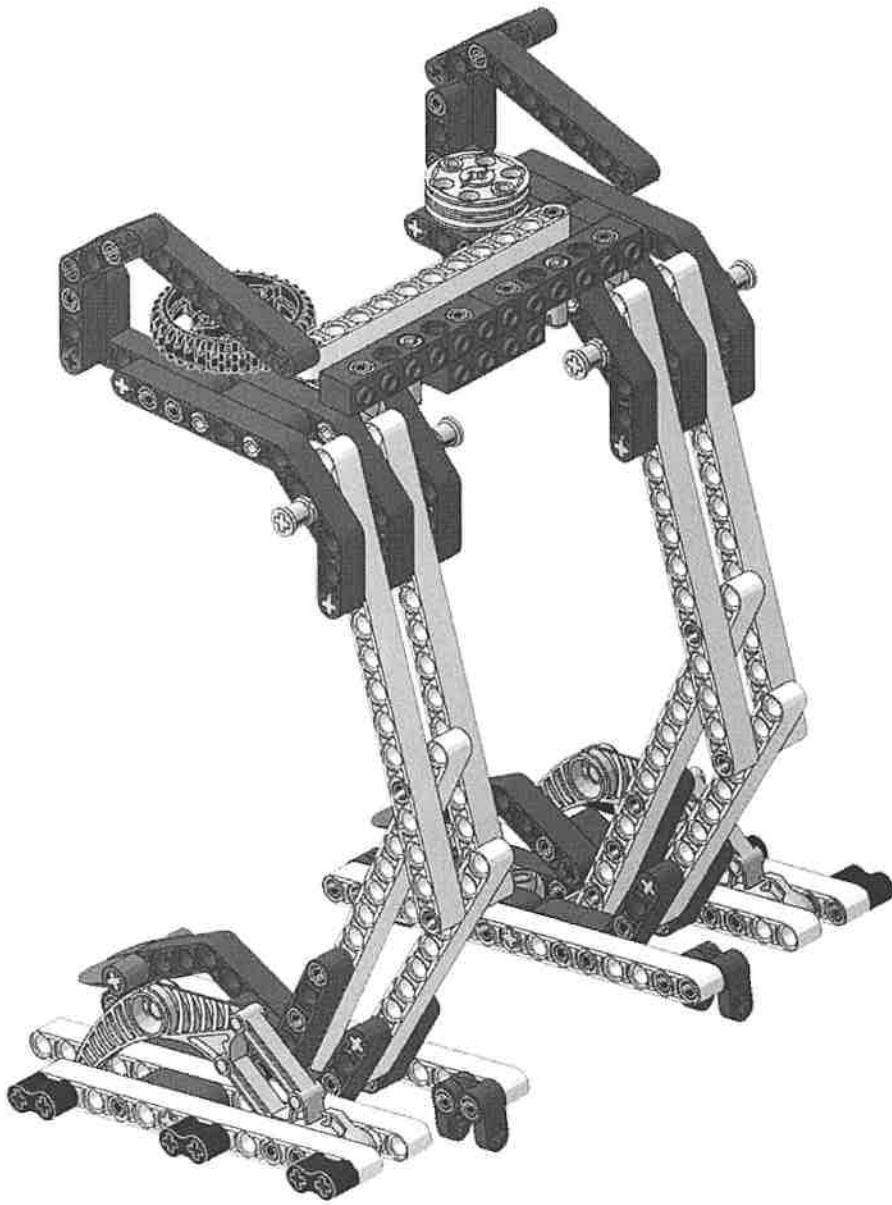
Step 91



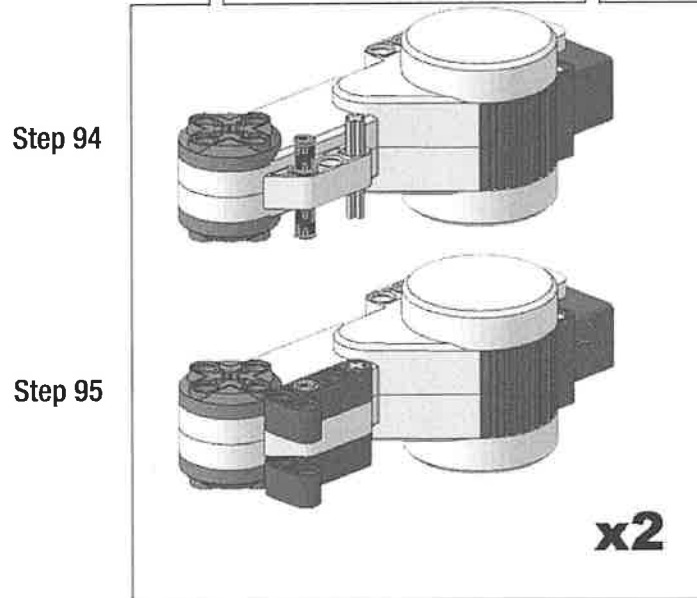
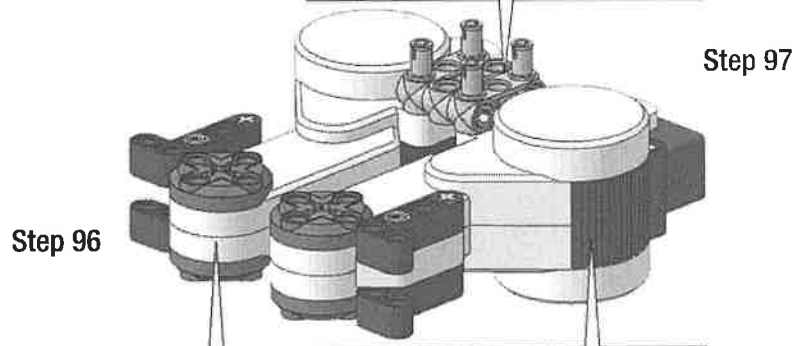
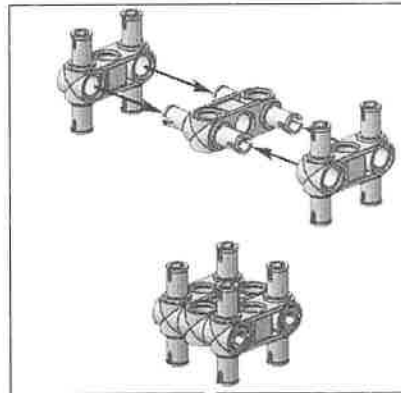
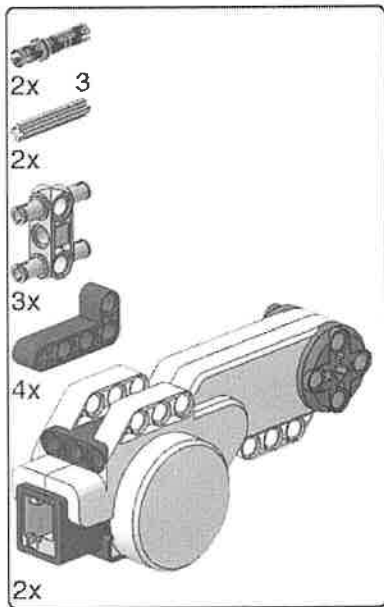
To make the legs move parallel to each other, insert another 11-long beam and the brick assembly.



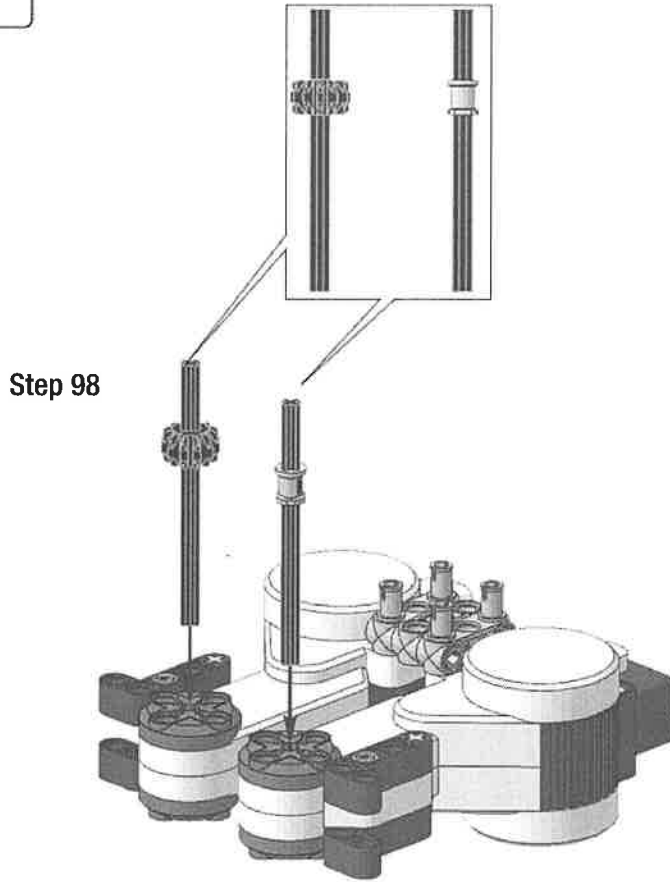
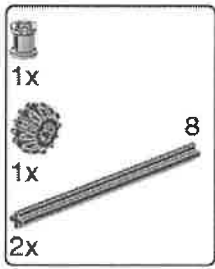
This picture shows how the AT-ST looks when assembled with retail set parts only. Notice the two gray wheels on the right hip assembly and the black gear on the left hip.



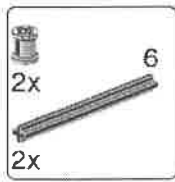
This picture shows the AT-ST legs without the additional 15-long beams. You can remove those beams safely, because they aren't structural.



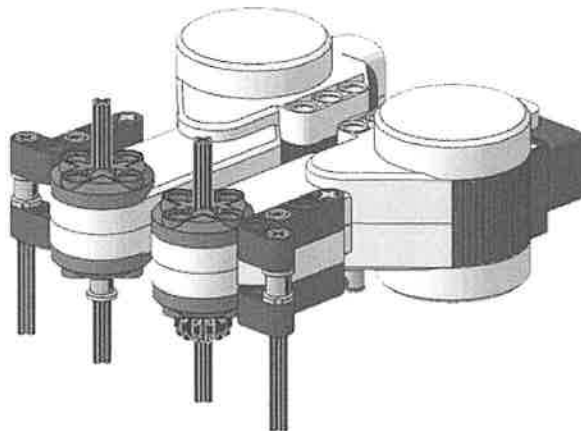
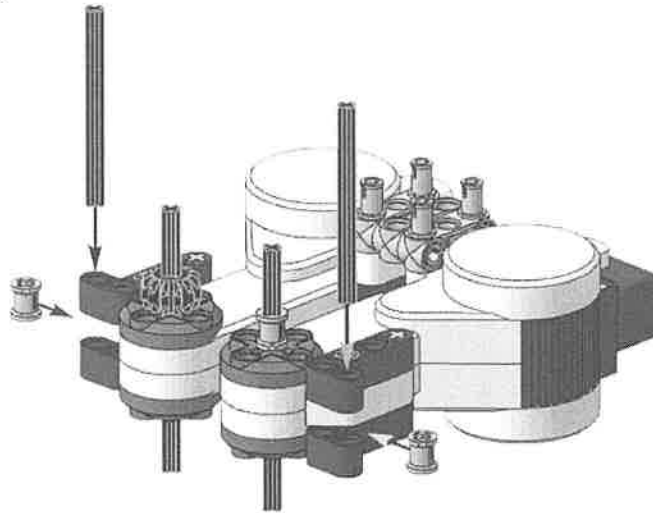
Now build the subassembly for the motors.



Insert two 8-long axles in the motor shafts. The callout shows where to place the bush and the gear.

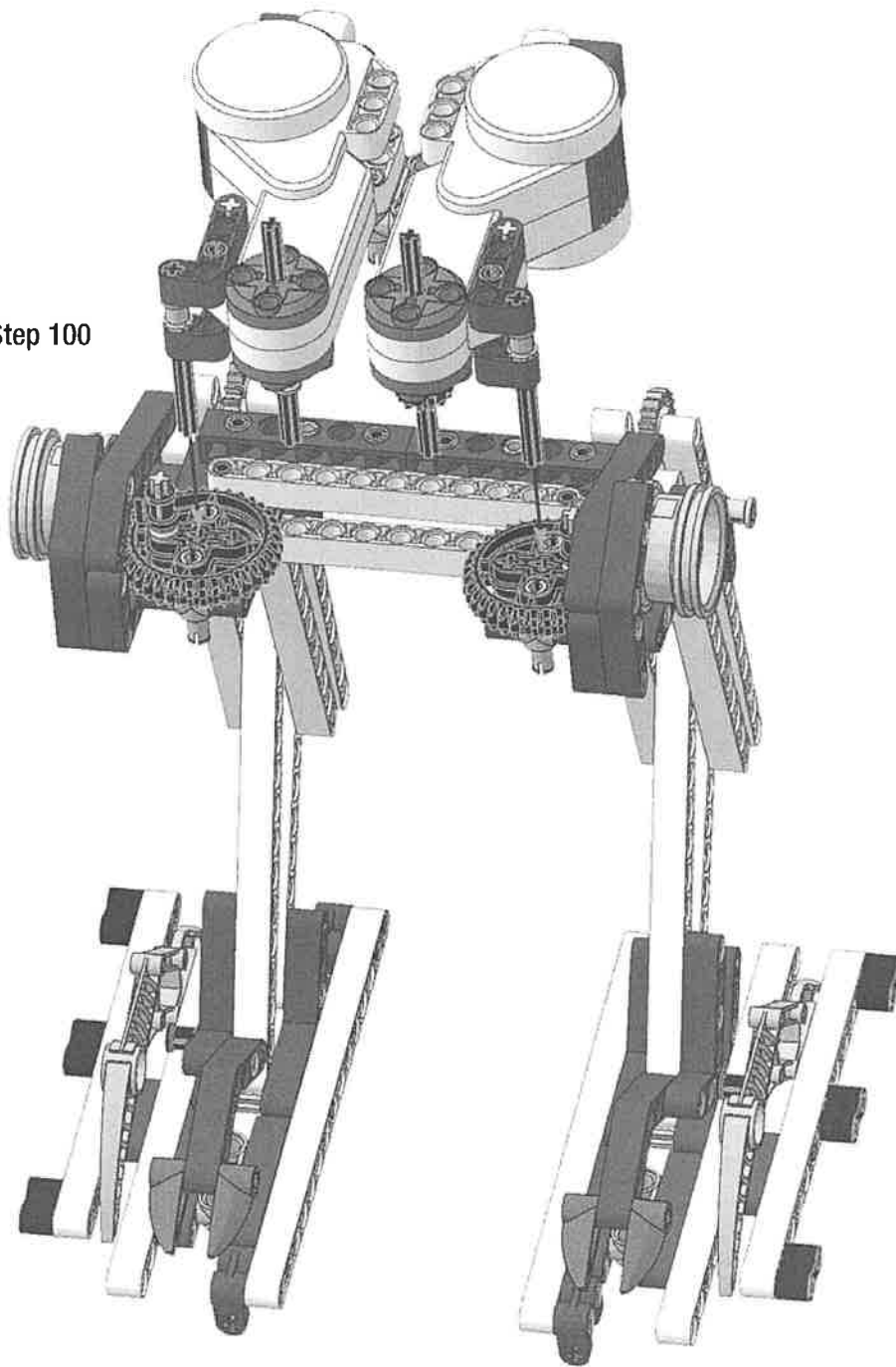


Step 99

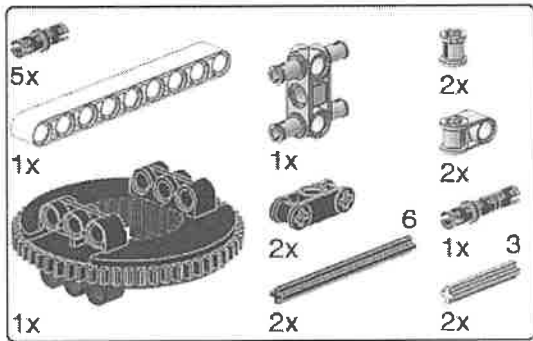


Insert the 6-long axles, fixing them with the bushes. Rotate the model and check if you inserted the axles correctly.

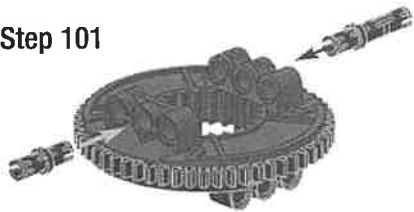
Step 100



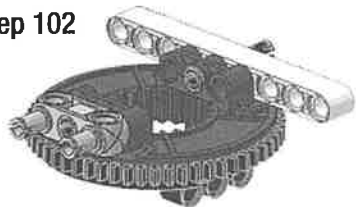
Attach the motors' subassembly on the legs. Insert the 6-long axles in the black gear's central hole (left leg) and in the gray wheel's central hole (right leg). However, if you have two black gears, the model looks as in this picture.



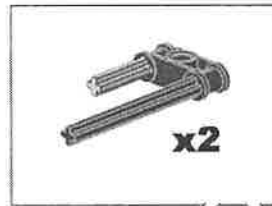
Step 101



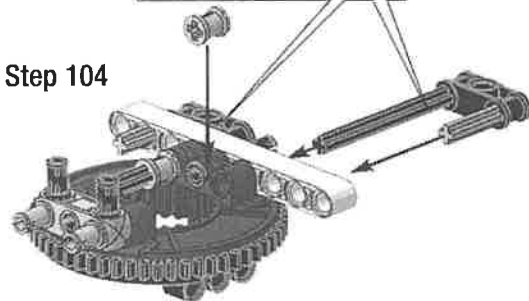
Step 102



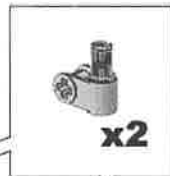
Step 103



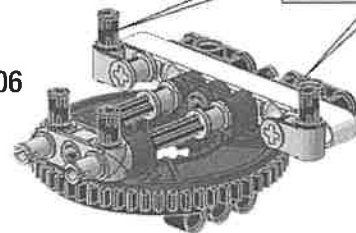
Step 104



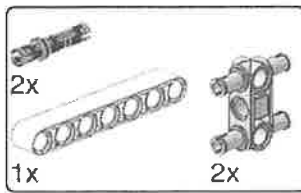
Step 105



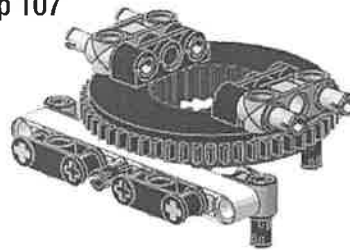
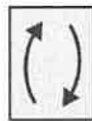
Step 106



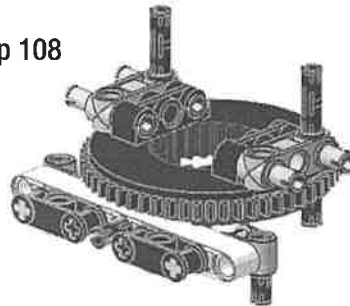
Build the rotating neck.



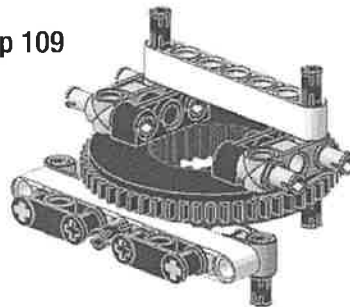
Step 107



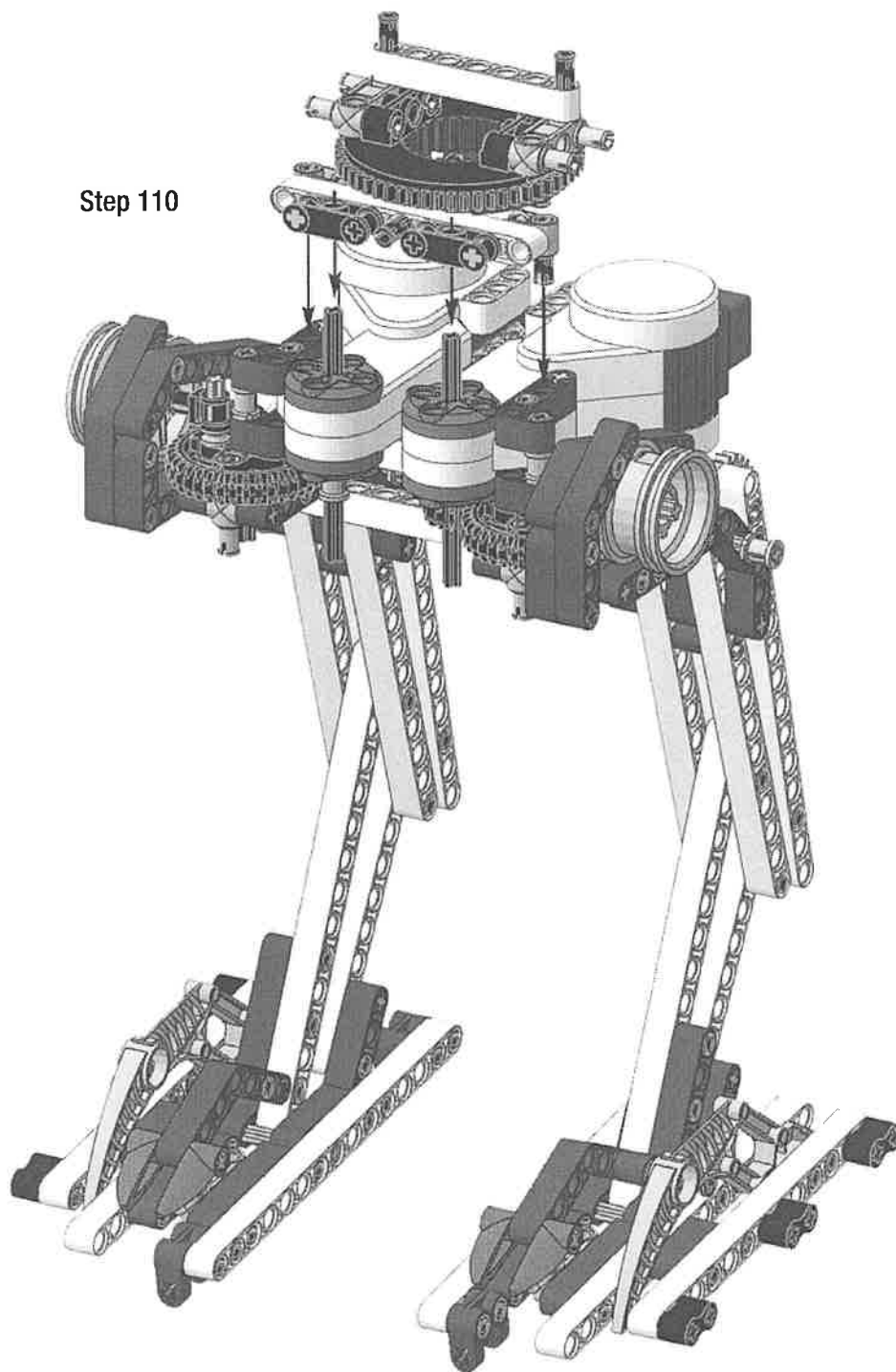
Step 108



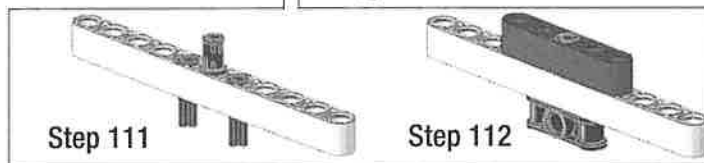
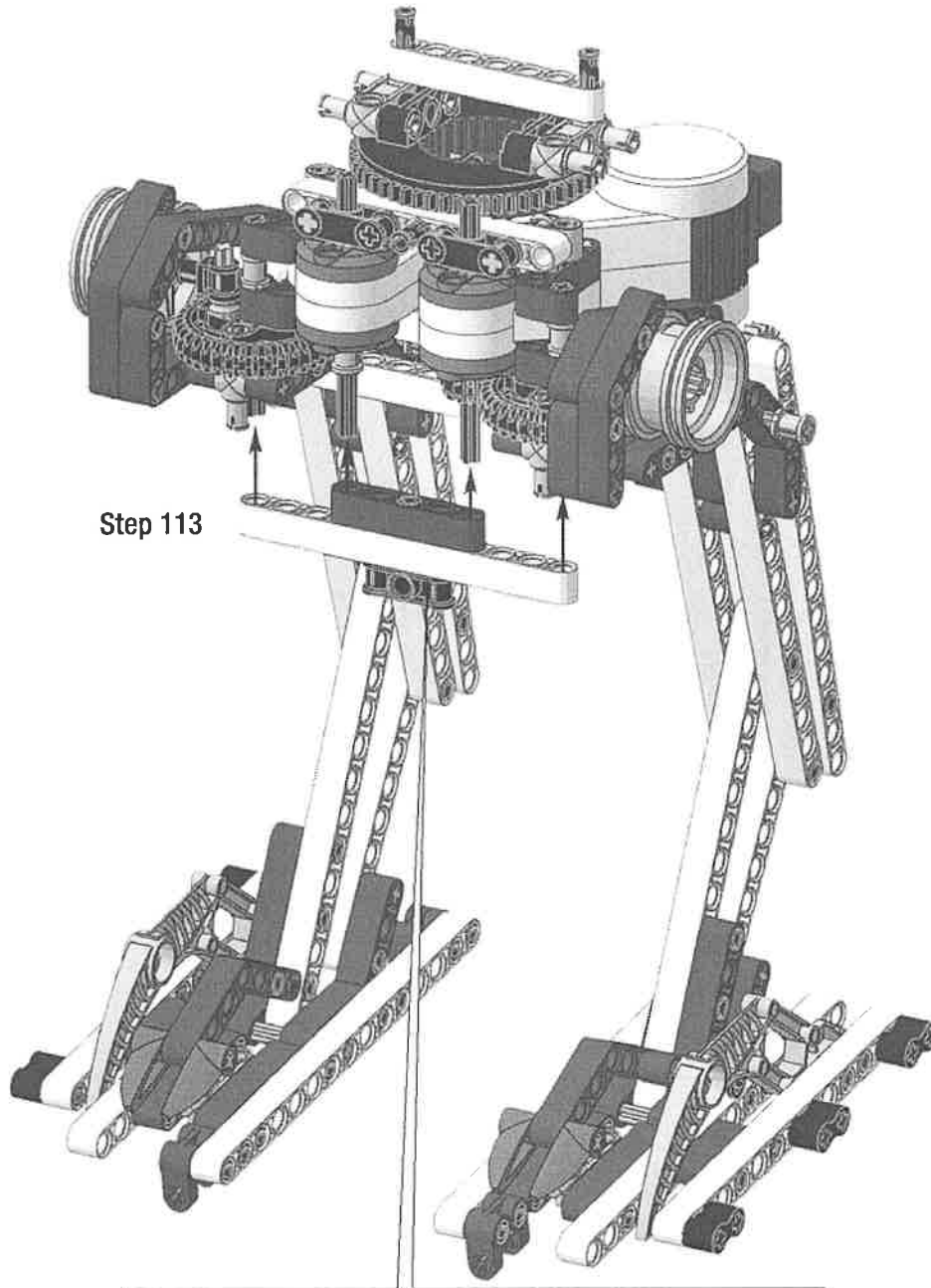
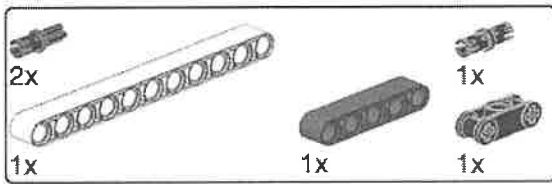
Step 109



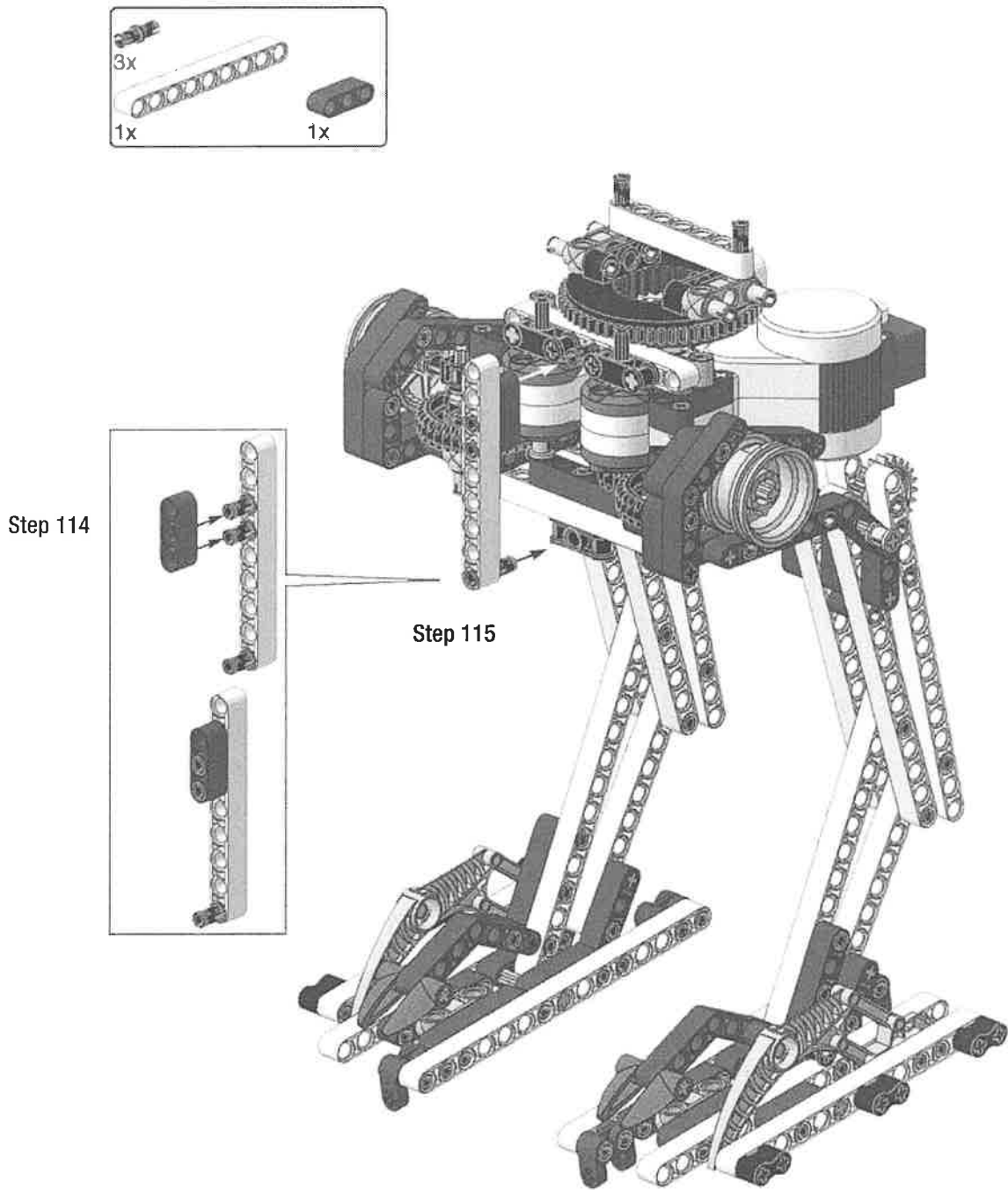
Rotate the model upside down and finish the neck assembly.



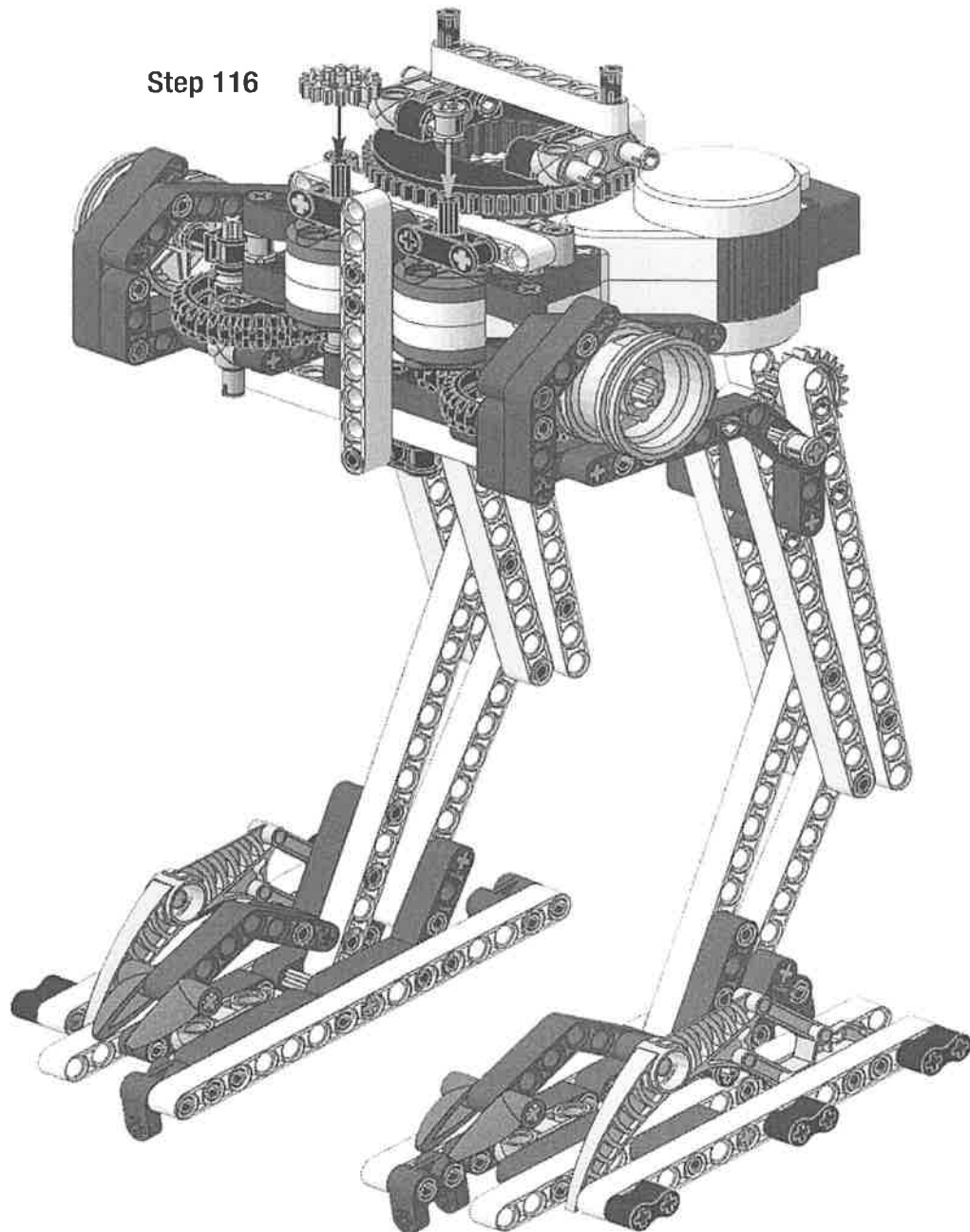
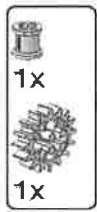
This graphic shows the motors attached to the legs, and also how to insert the neck in place.



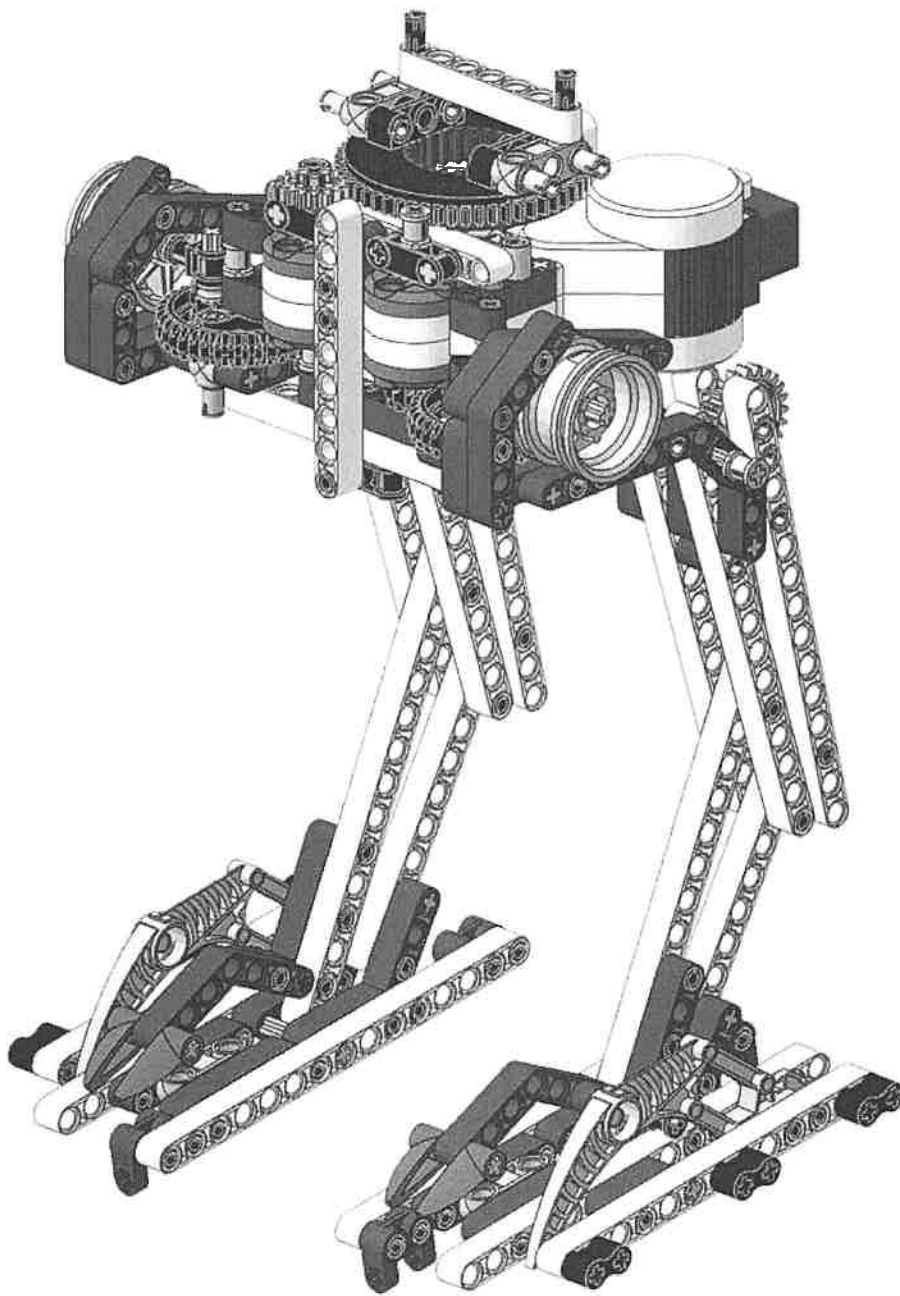
Build the beam that will hold the legs firmly.



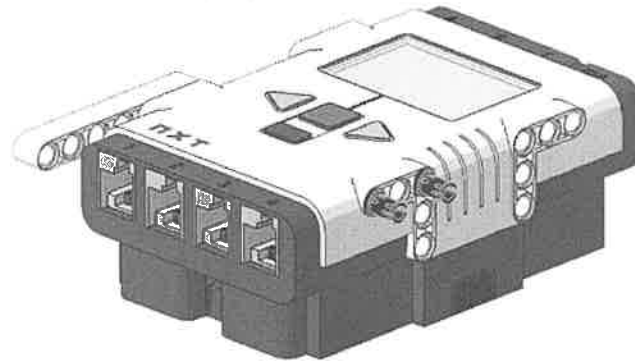
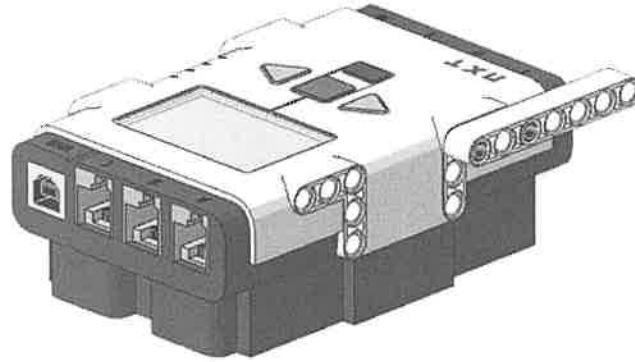
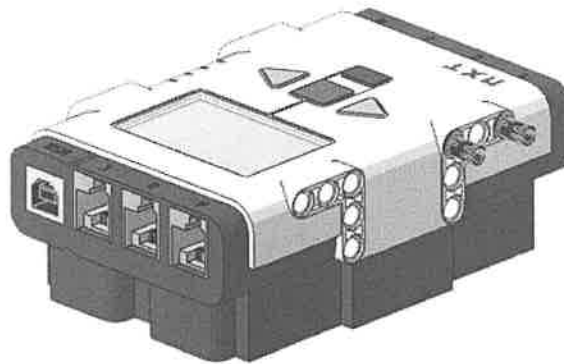
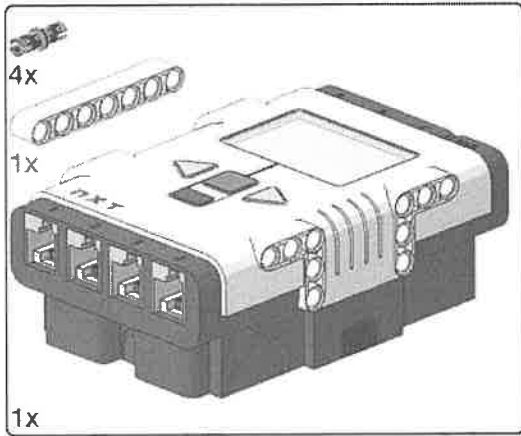
Insert the cross-bracing beam that holds the legs. Notice that you can't detach the legs from the AT-ST if this beam is in place.



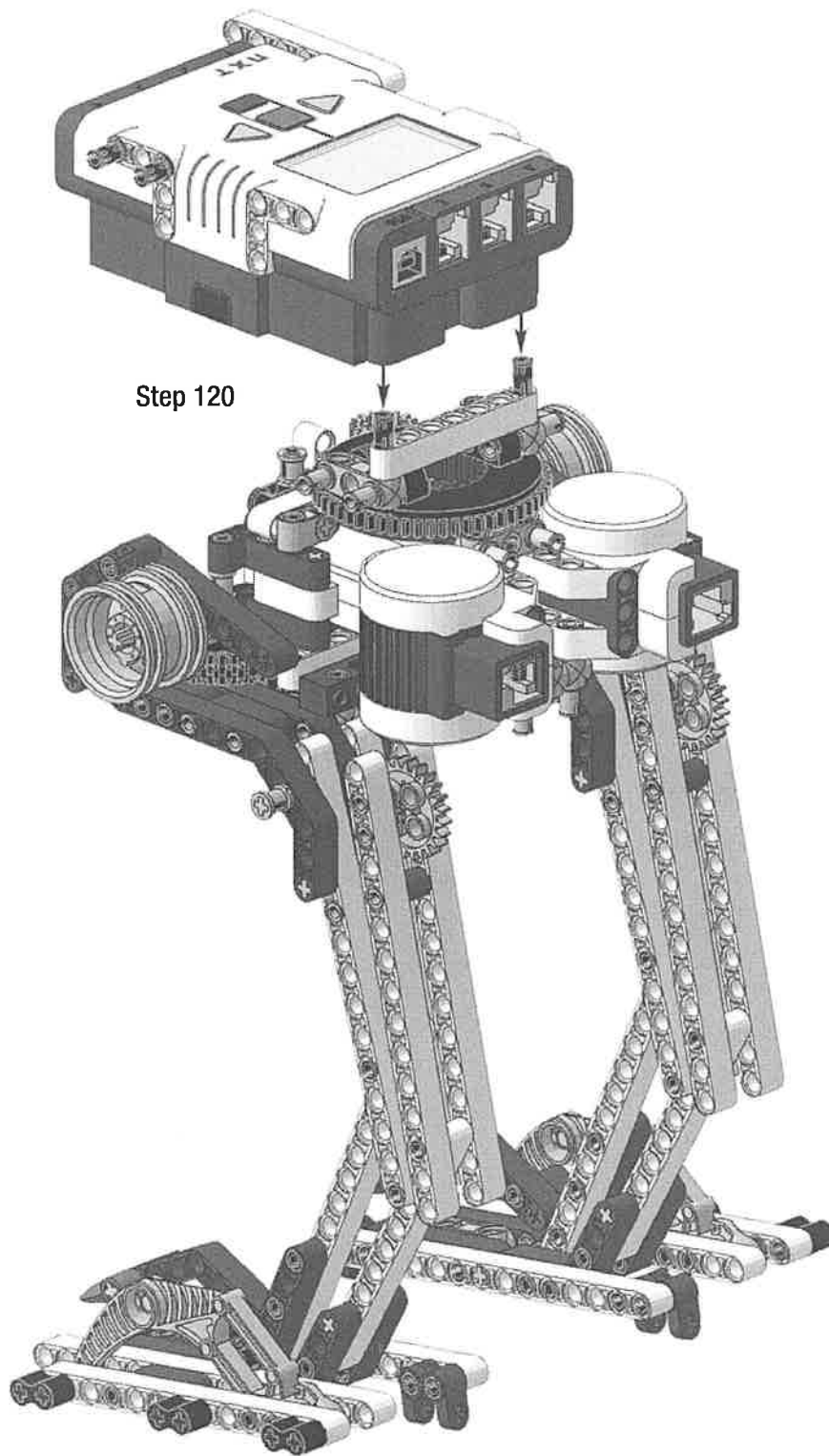
Insert the 16-tooth gear and the bush in their places.



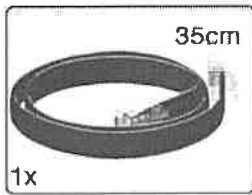
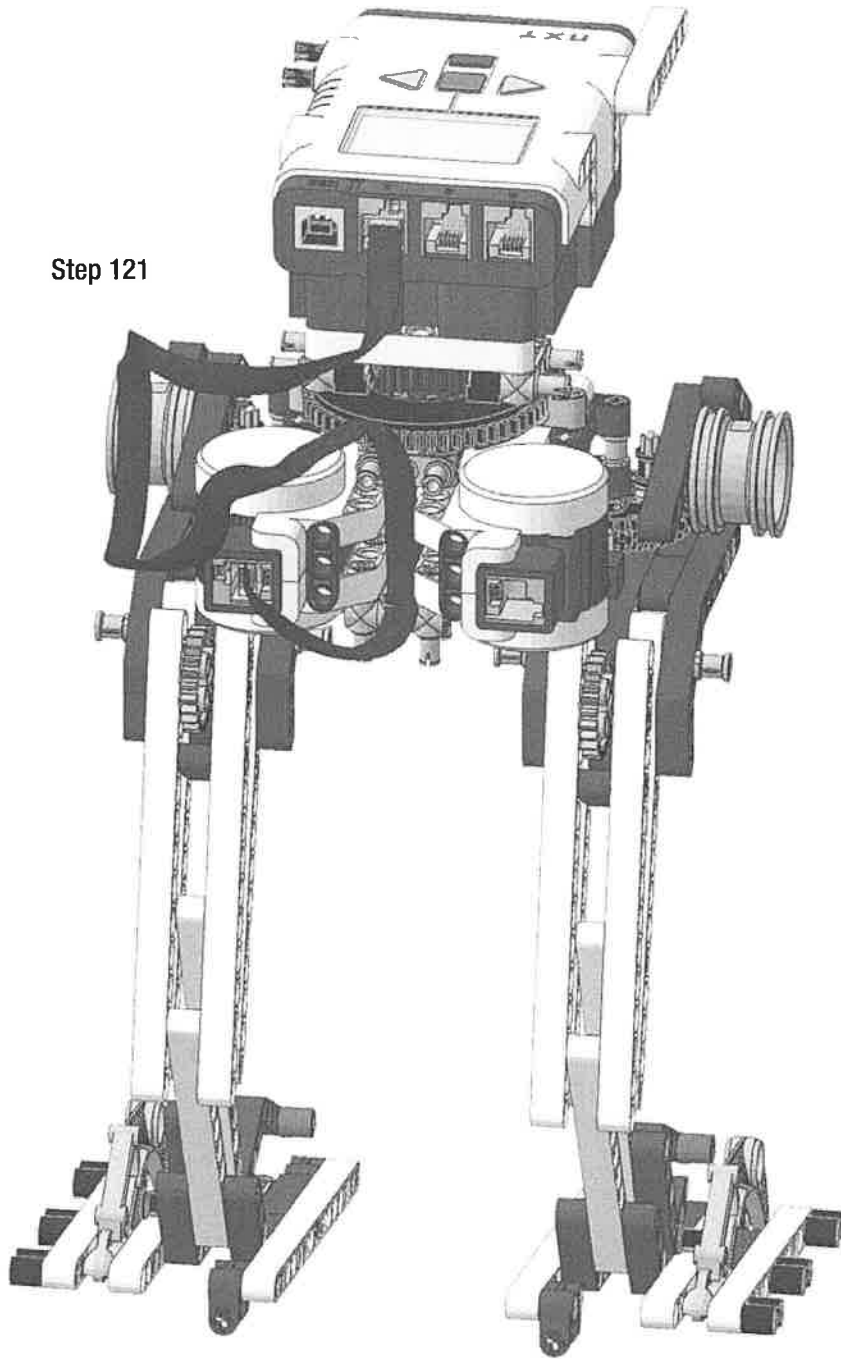
Notice that the right motor gear (on top) engages the neck turntable, while the left motor 12-tooth gear (on bottom) engages the left leg's black gear.



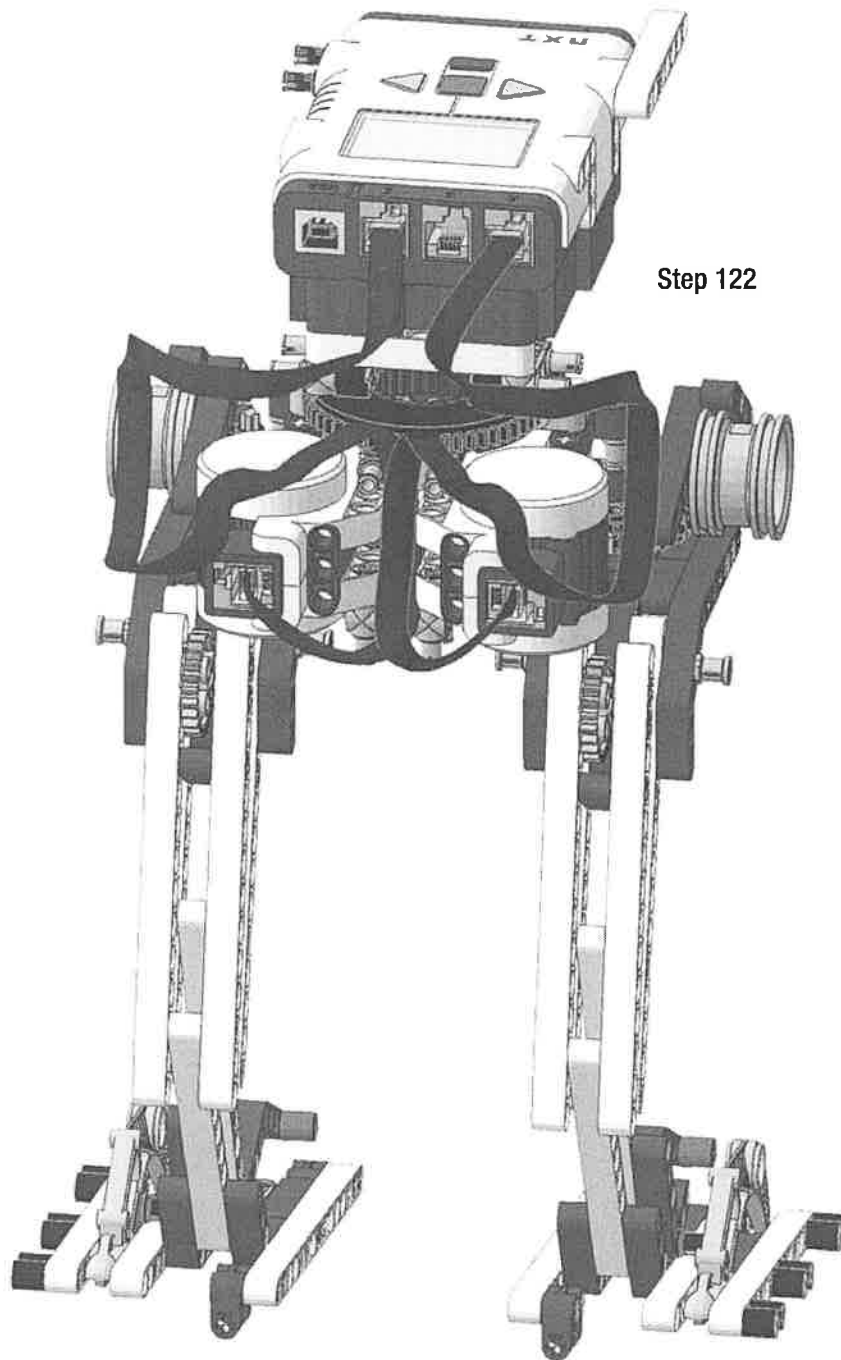
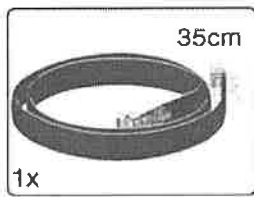
The NXT is used as the AT-ST head.



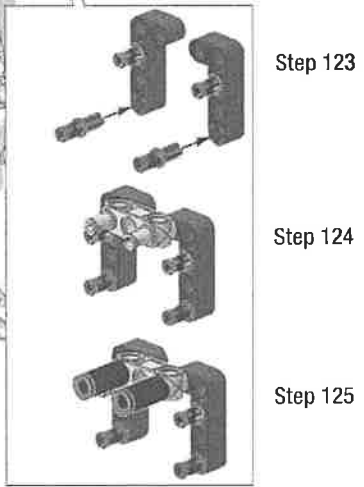
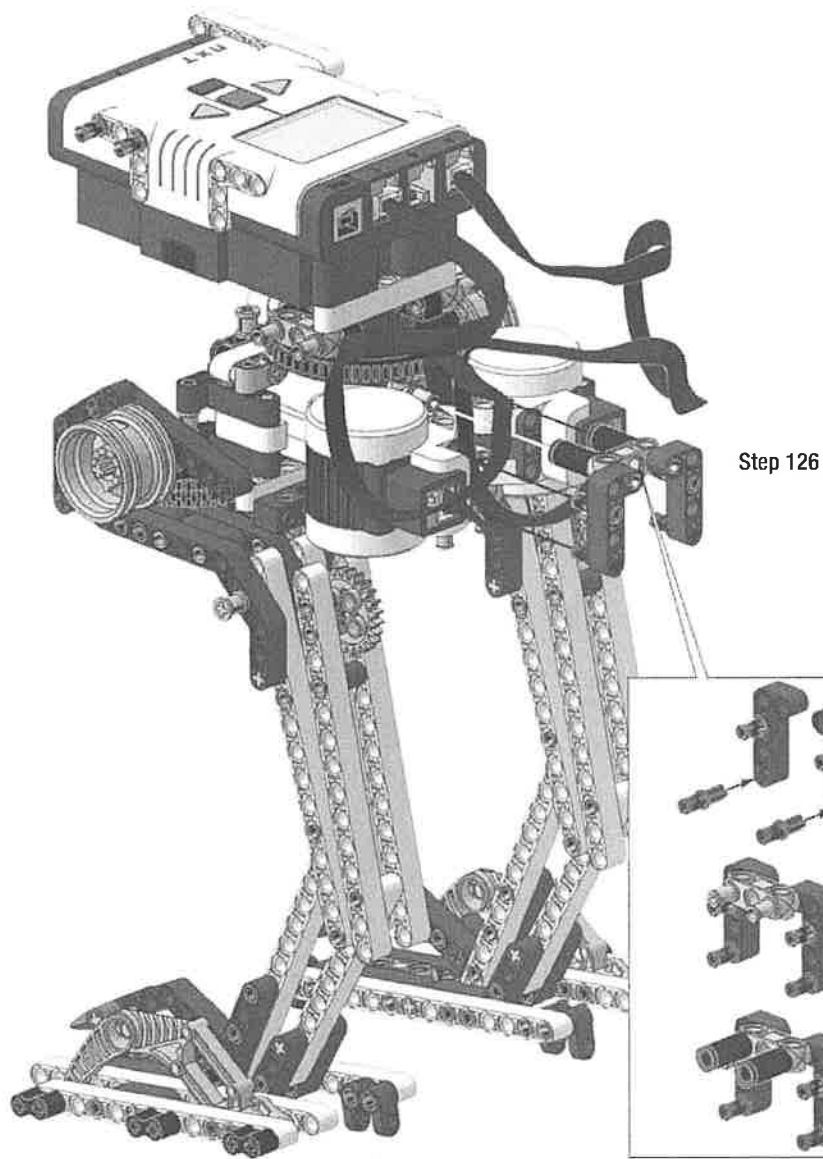
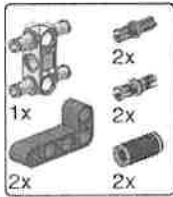
Attach the head to the neck. Be careful; the NXT is not secured to the neck yet.

**Step 121**

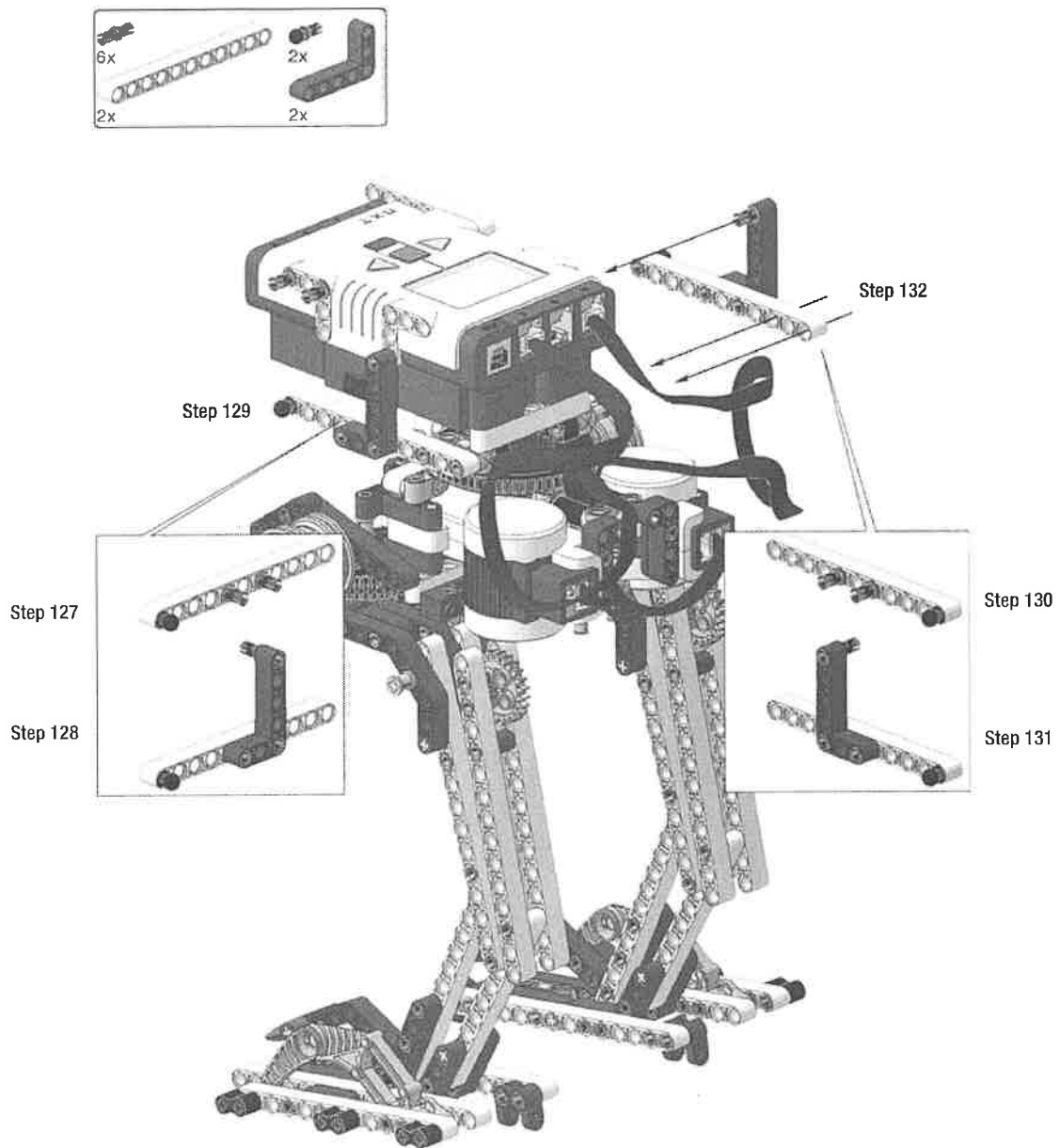
Connect the left motor to NXT output port C using a 35cm (14 inch) cable.



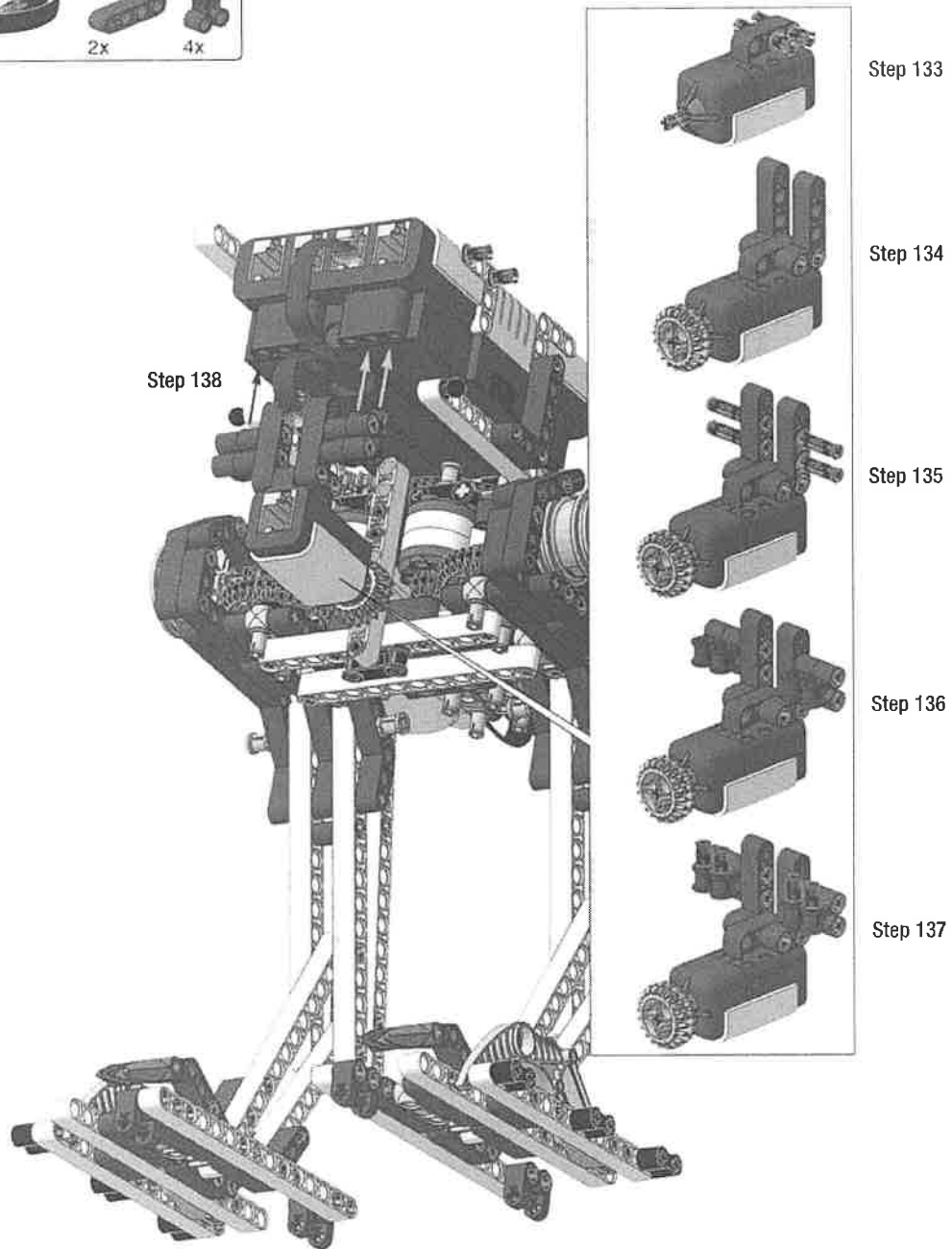
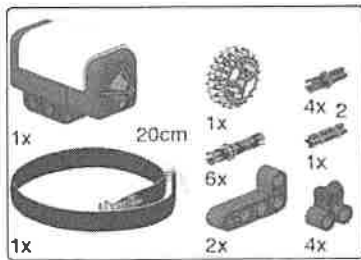
Connect the right motor to NXT output port A using a 35cm (14 inch) cable.



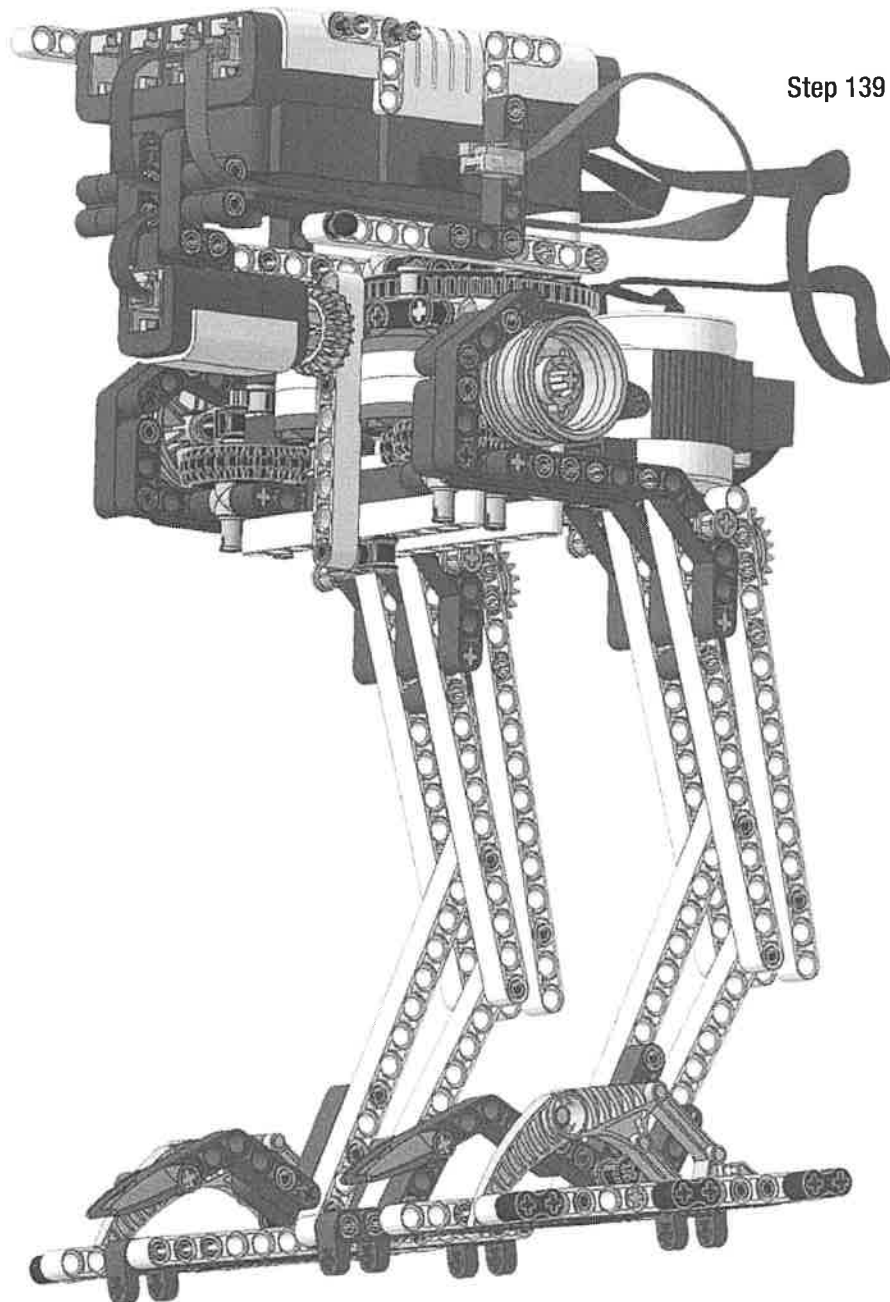
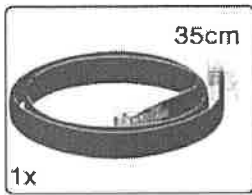
This frame will firmly connect the neck to the motors. Also, this time use the cross-bracing technique.



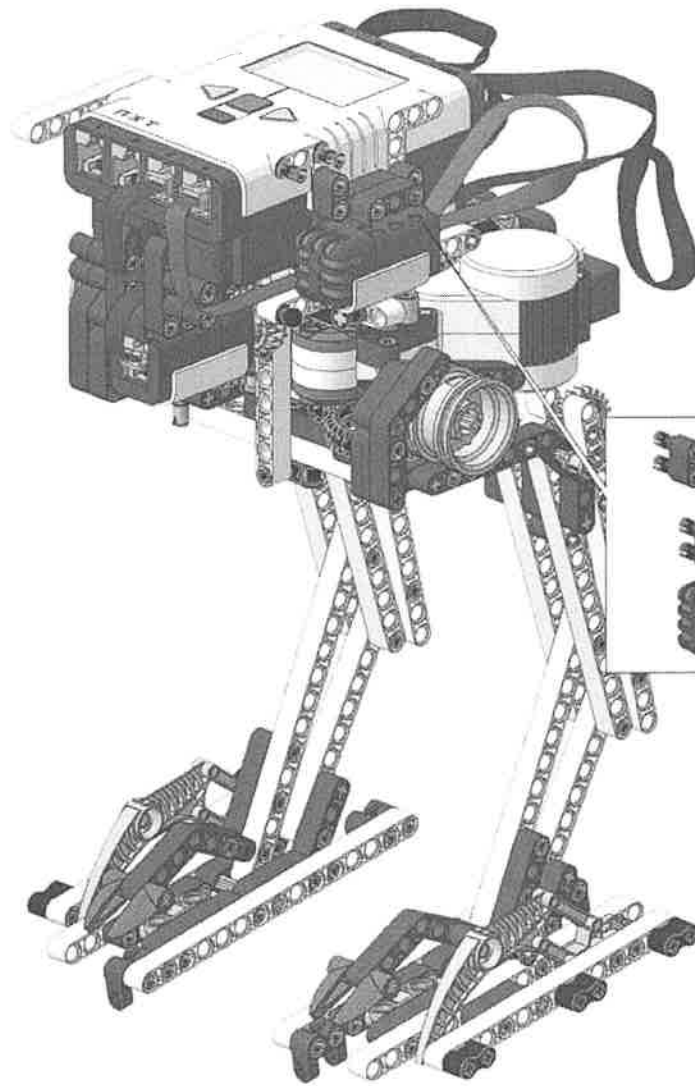
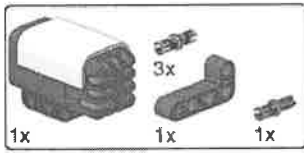
Attaching these side assemblies will secure the NXT to the neck, and so to the rest of the robot.



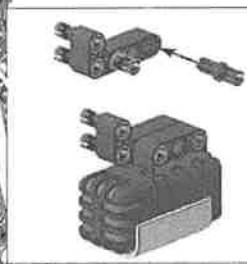
Build the Touch Sensor assembly and attach it under the head. Connect the Touch Sensor to NXT input port 3 using a 20cm (8 inch) cable.



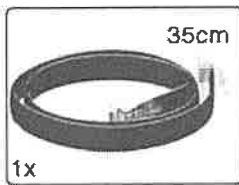
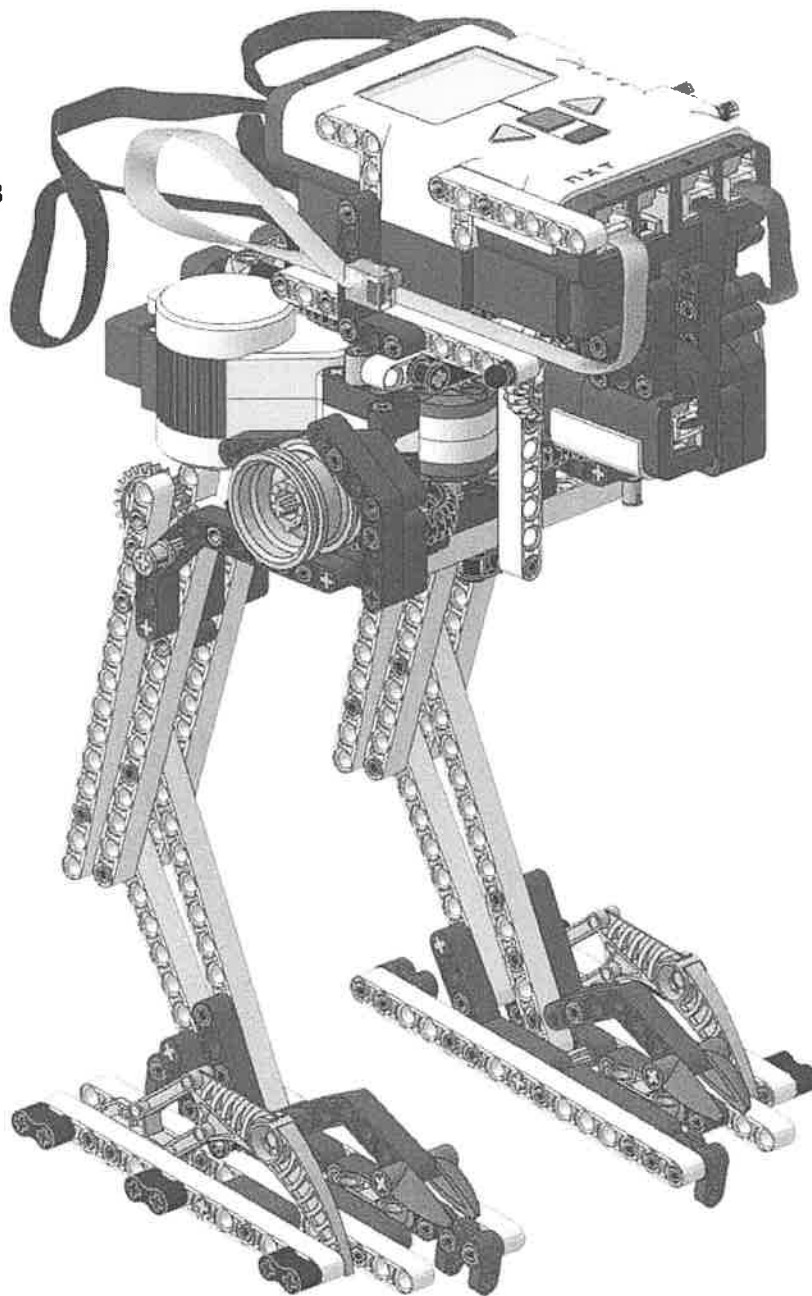
Attach a 35cm (14 inch) cable to NXT input port 4 and pass it under the bent beam on the left side of the head.



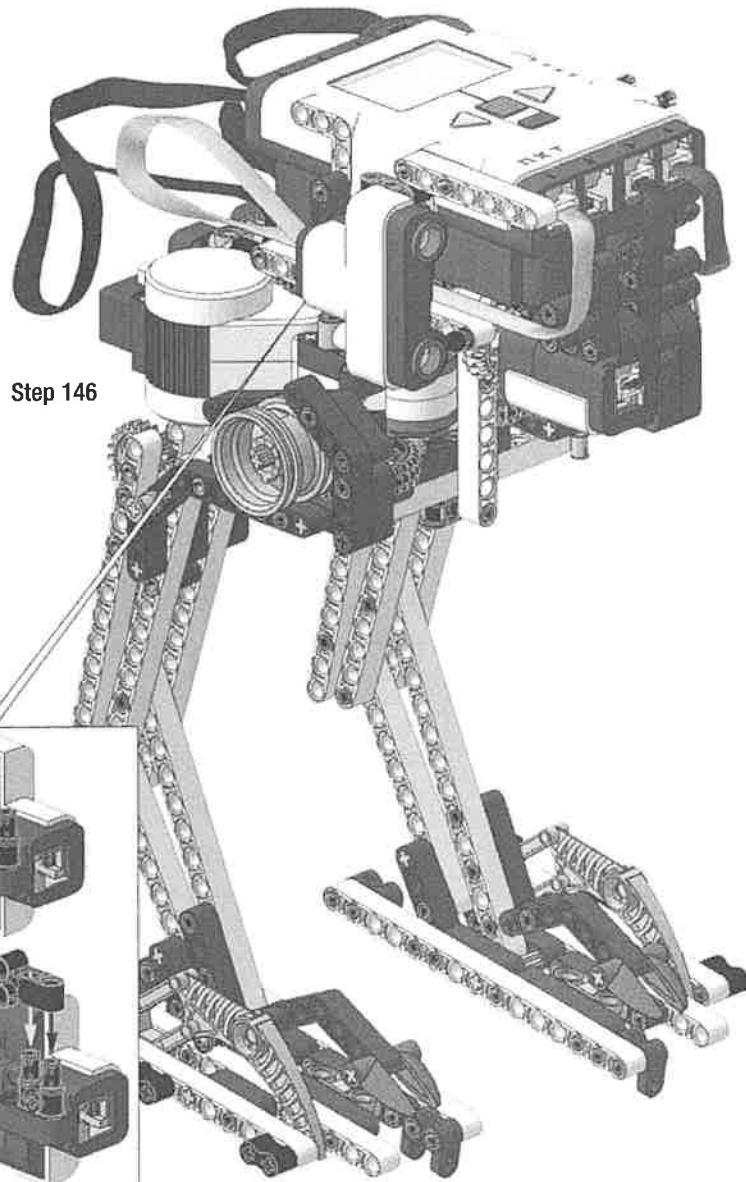
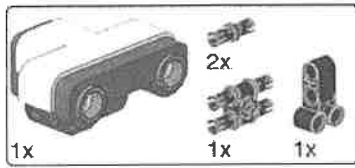
Step 142



Build the Sound Sensor assembly and attach it to the NXT and to the cable left free in the preceding step.

**Step 143**

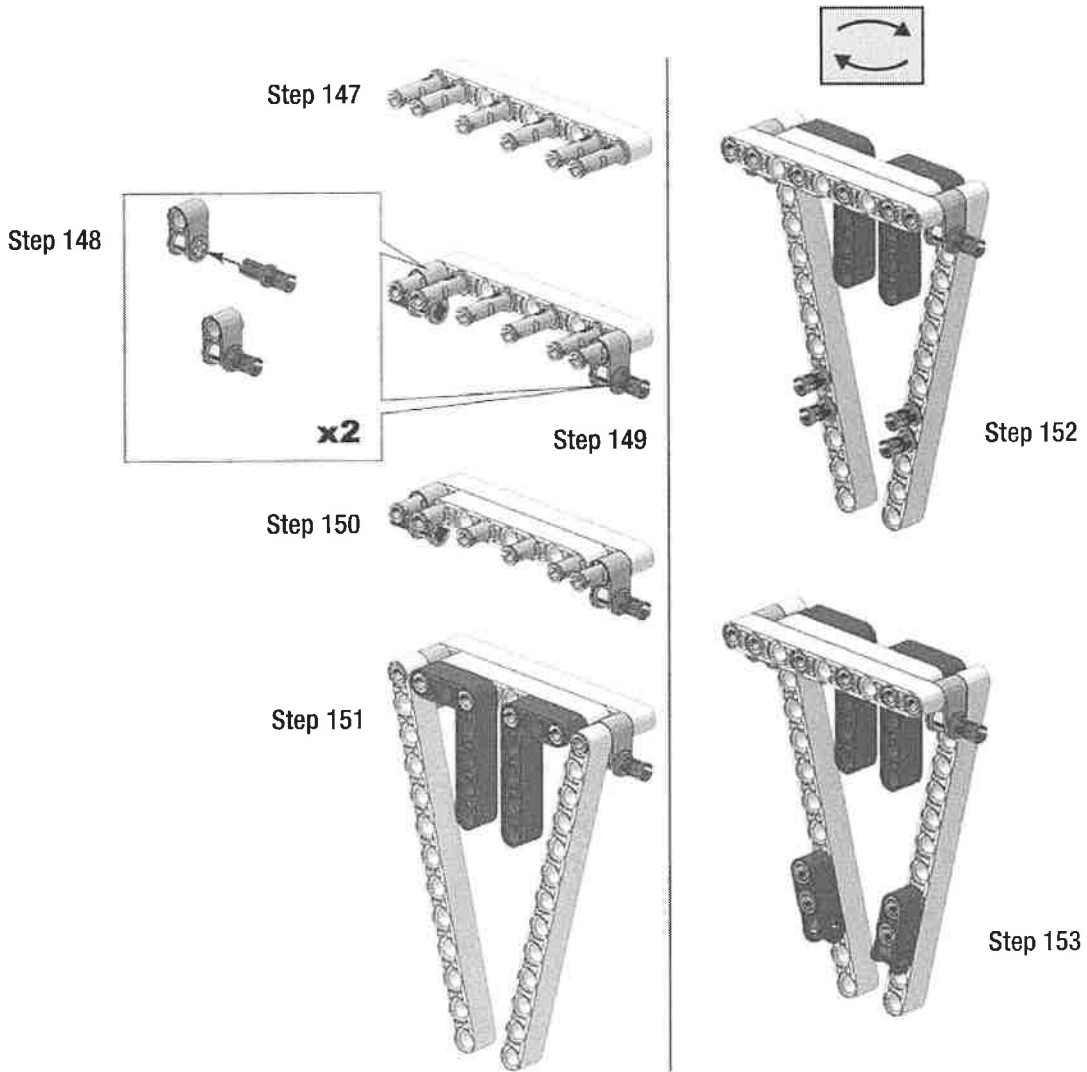
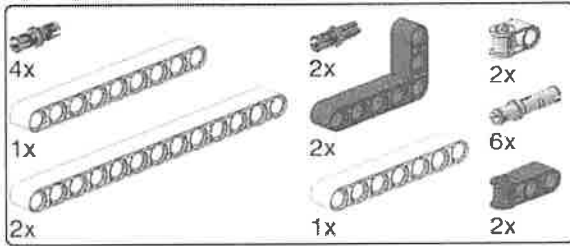
Turn the model and attach another 35cm (14 inch) cable to NXT input port 1, passing it under the bent beam on the right side of the head.



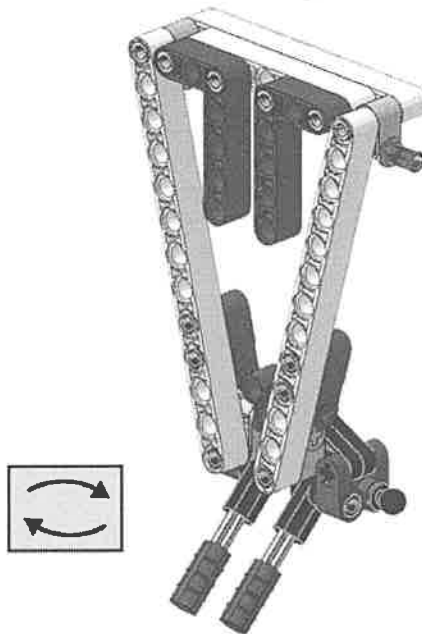
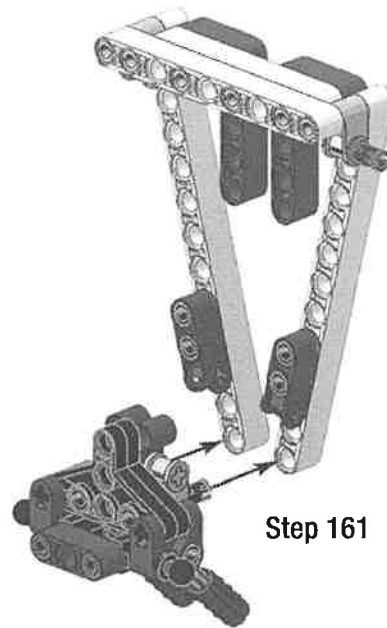
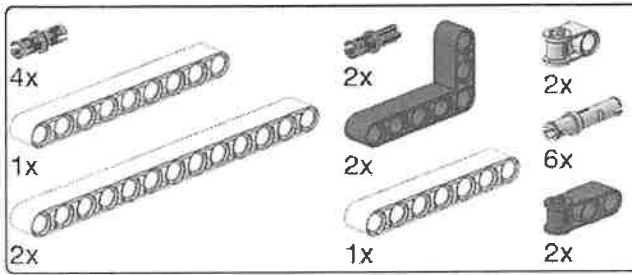
Step 144

Step 145

Build the Ultrasonic Sensor assembly and attach it to the NXT and to the cable left free in the preceding step.

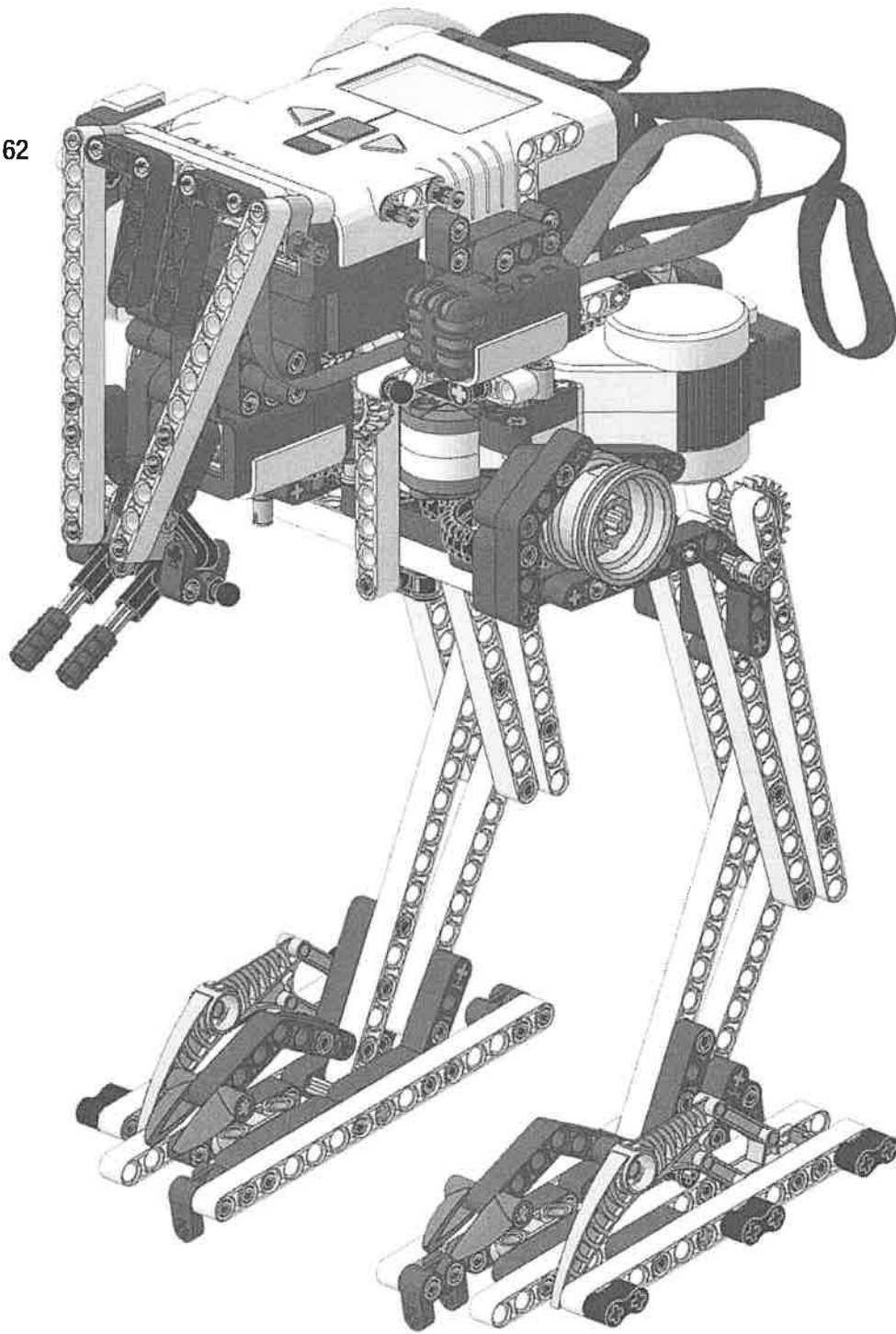


Start building the face of the robot.

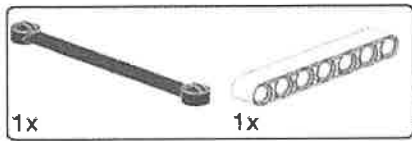


Complete the AT-ST face assembly.

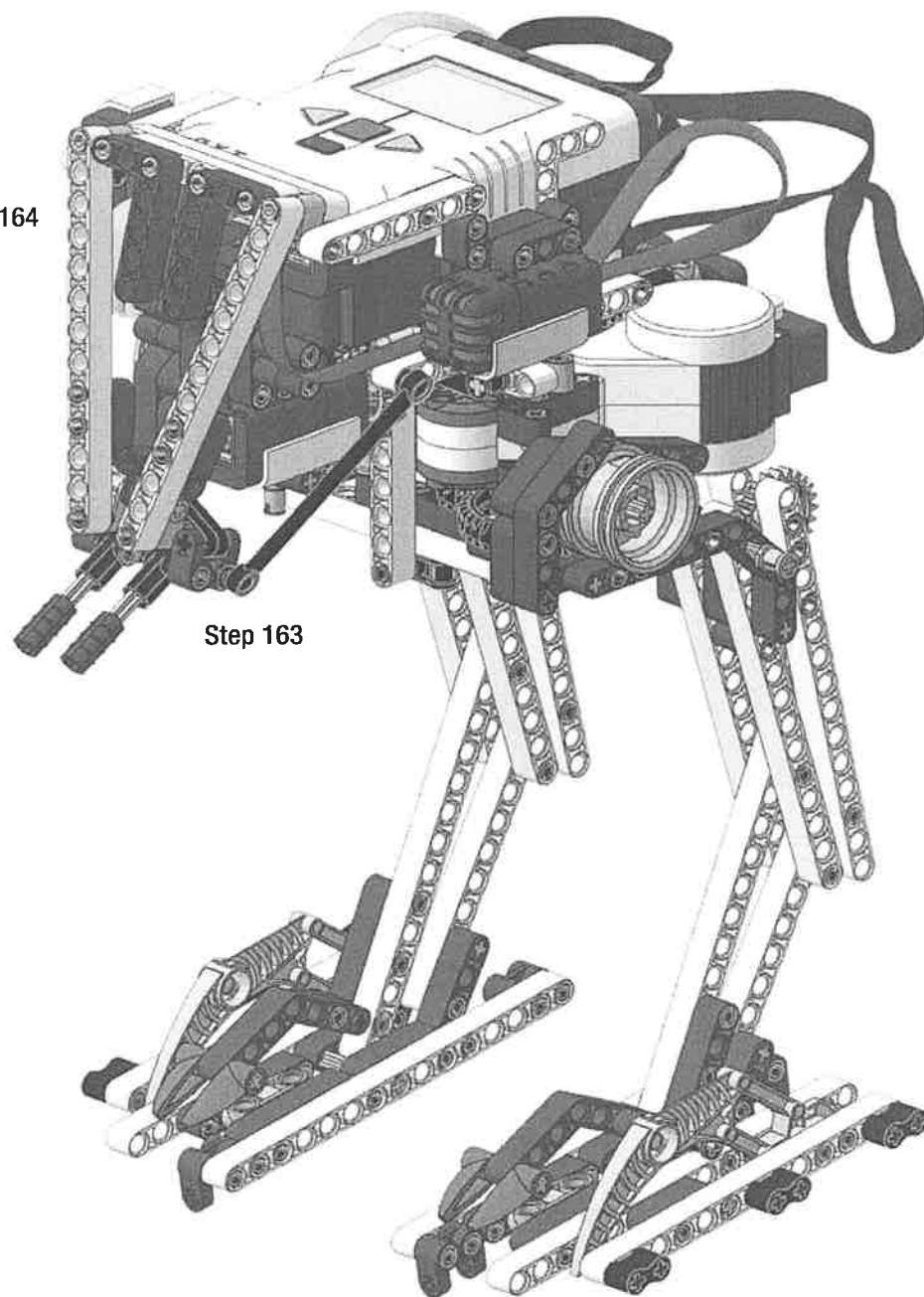
Step 162



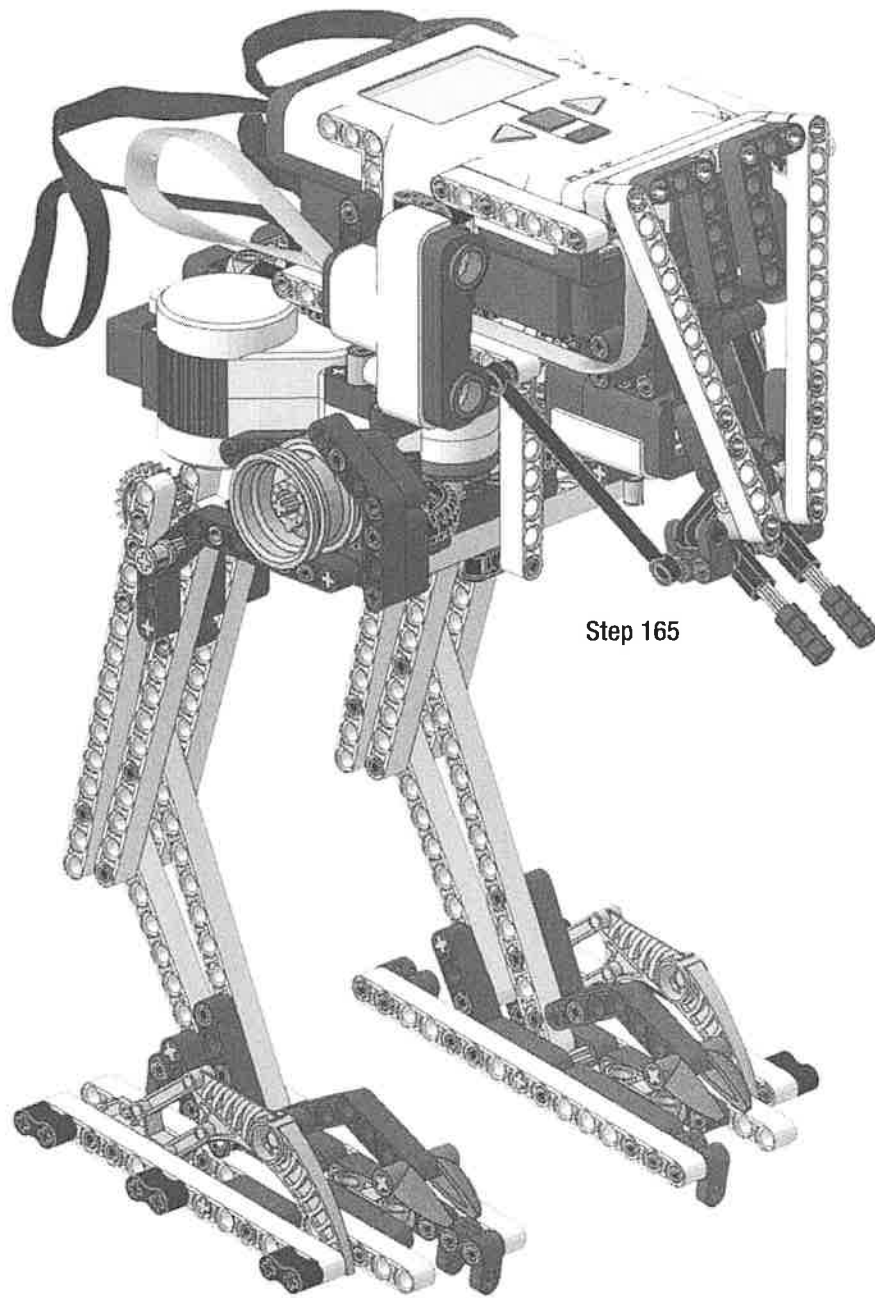
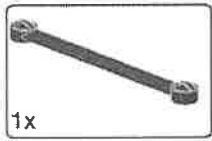
Attach the face to the rest of the head.



Step 164



Place a 7-long beam and a black steering link to hold the head.



Add another link on the right side and the AT-ST is ready for battle!