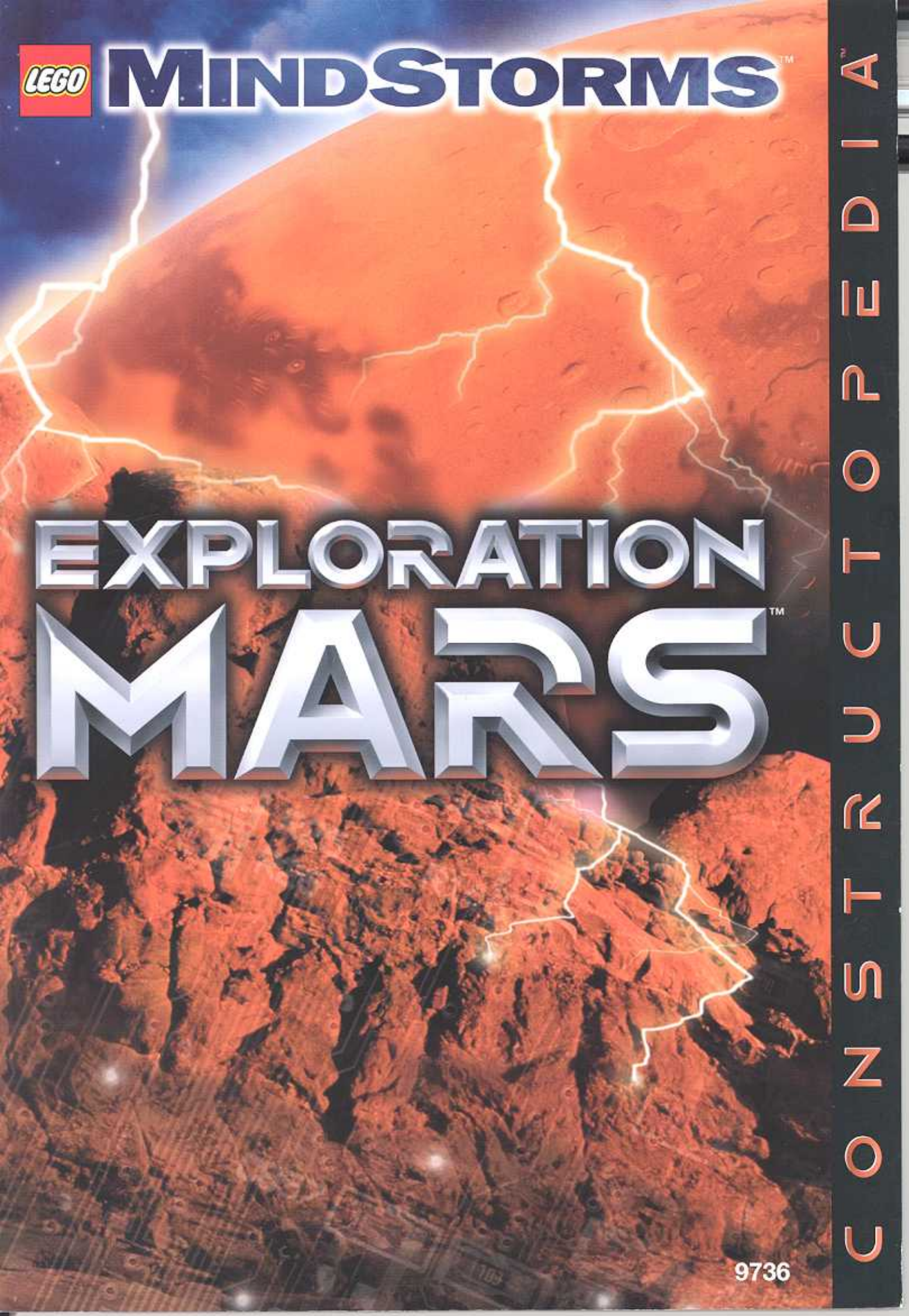
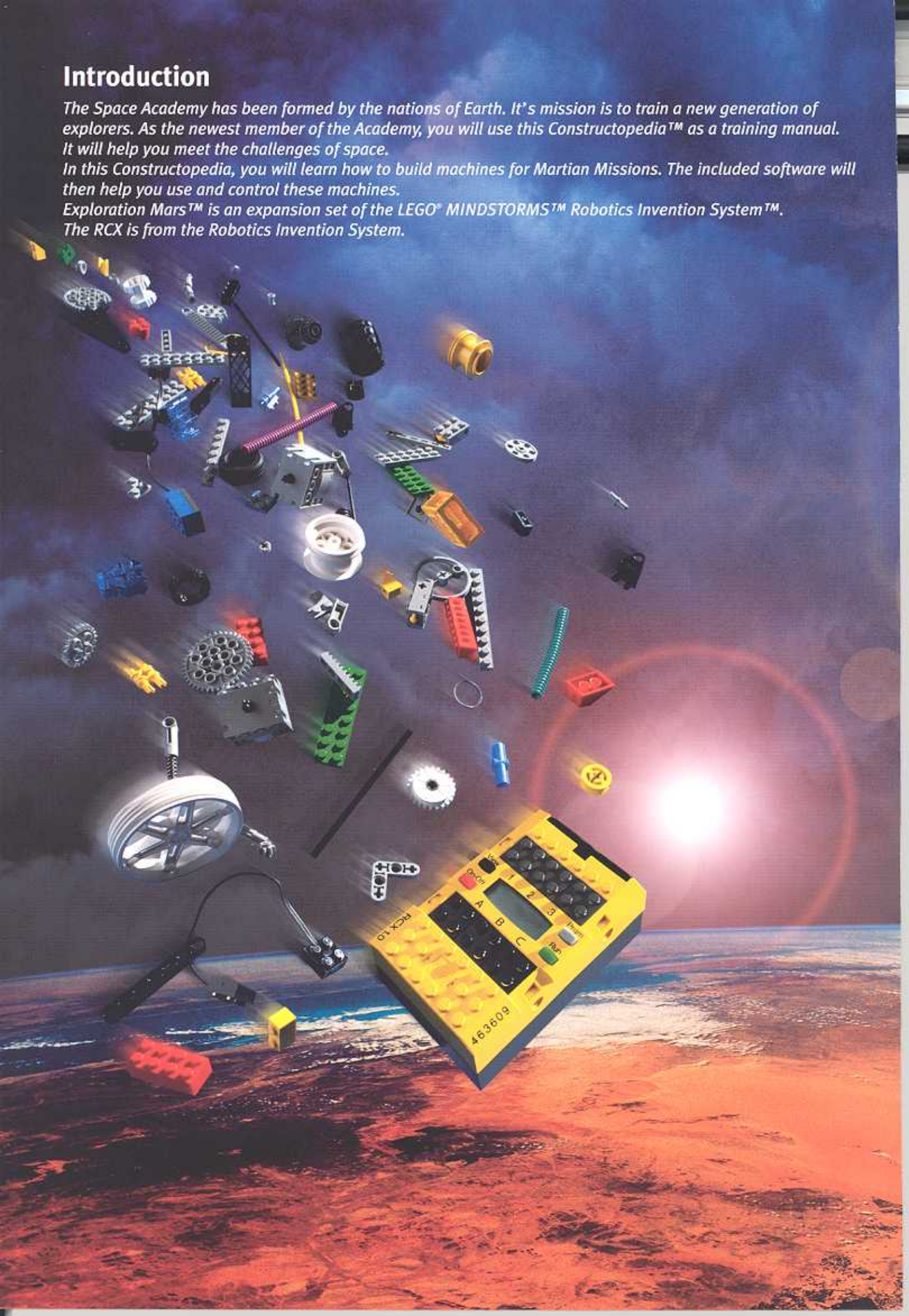

LEGO MINDSTORMS
EXPLORATION MARS
CONSTRUCTOPEDIA
9736

Introduction

The Space Academy has been formed by the nations of Earth. It's mission is to train a new generation of explorers. As the newest member of the Academy, you will use this Constructopedia™ as a training manual. It will help you meet the challenges of space.
In this Constructopedia, you will learn how to build machines for Martian Missions. The included software will then help you use and control these machines.
Exploration Mars™ is an expansion set of the LEGO® MINDSTORMS™ Robotics Invention System™.
The RCX is from the Robotics Invention System.



CONTENTS

PROJECT IDEAS

These are the models used to solve the Martian Missions on the CD-ROM. You can also design your own inventions for the Missions.

Rover 1

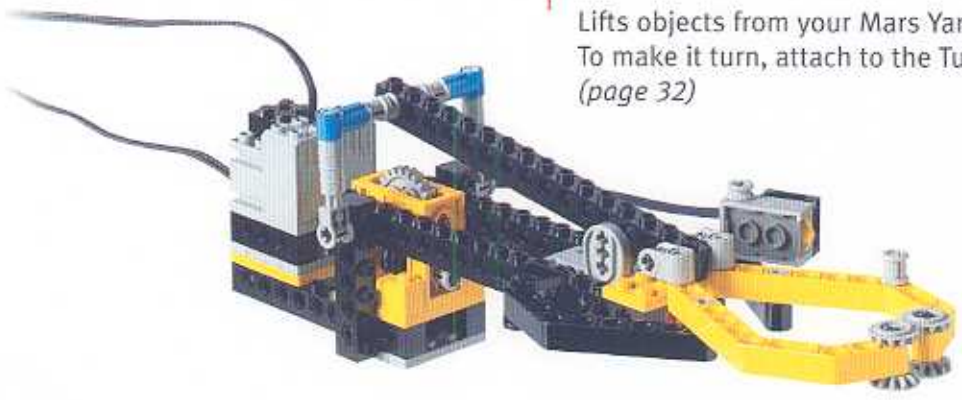
Basic Mars vehicle which can explore your Mars Yard.
(page 16)

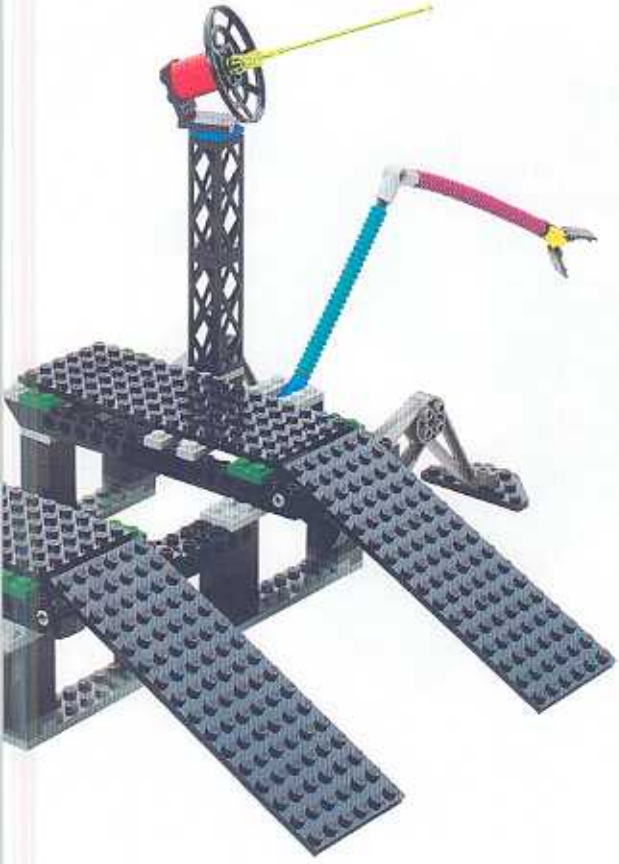
Rover 2

Rover with RCX standing upright. Much faster than Rover 1.
(page 22)

Robotic Arm

Lifts objects from your Mars Yard.
To make it turn, attach to the Turntable.
(page 32)



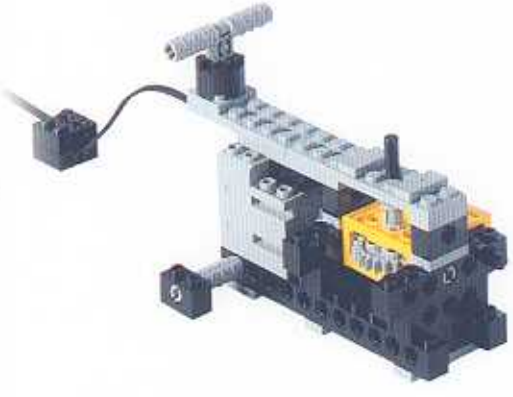


Mars Lander

The home base for all of your Missions. Build it first so you can use it with the other models.
(page 6)

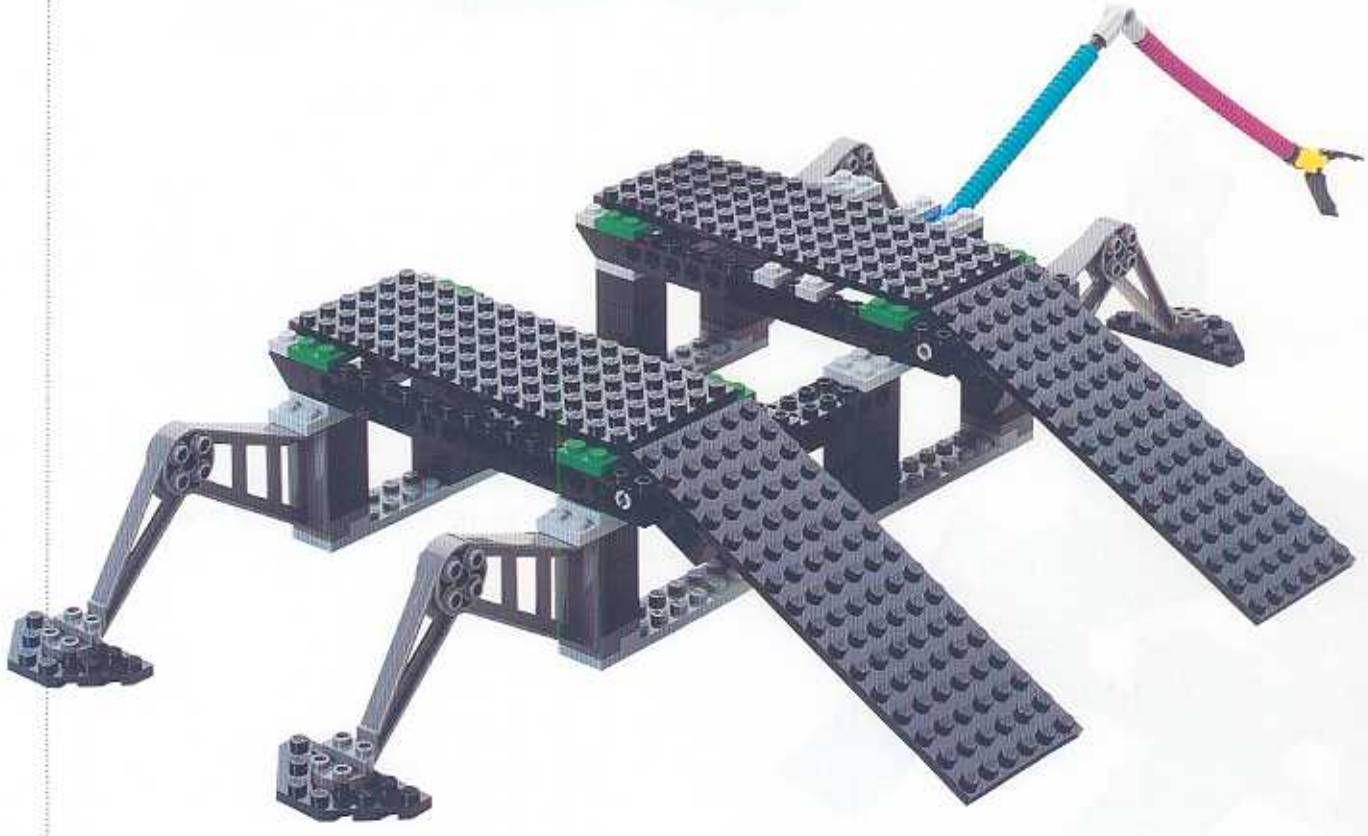
Turntable

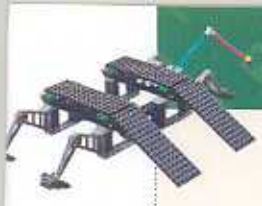
Adds motion to the Robotic Arm or PC video camera *(not included)*.
(page 28)



MARS LANDER

The following pages show you how to build the Mars Lander.





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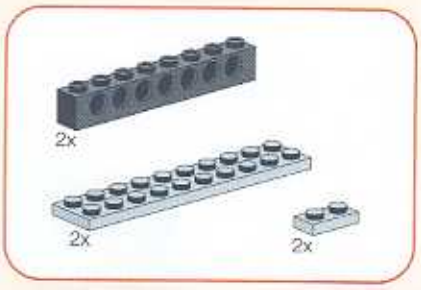

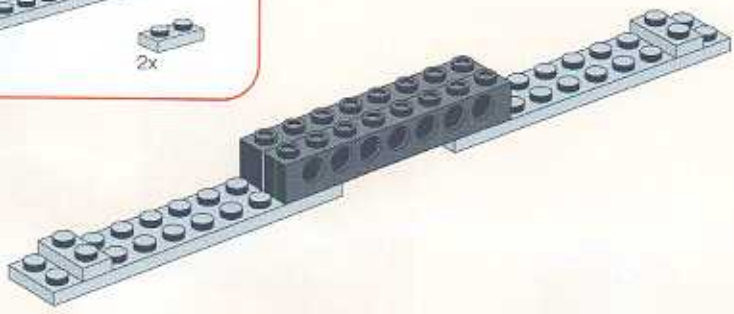

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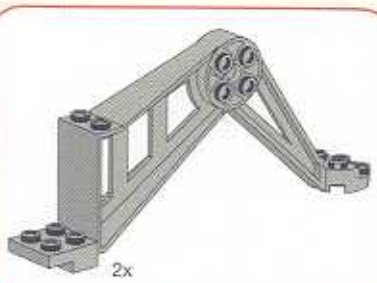

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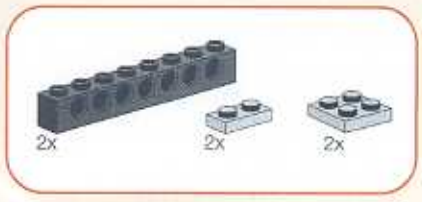

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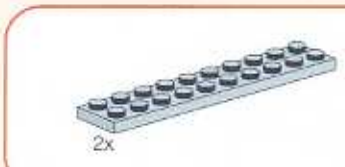

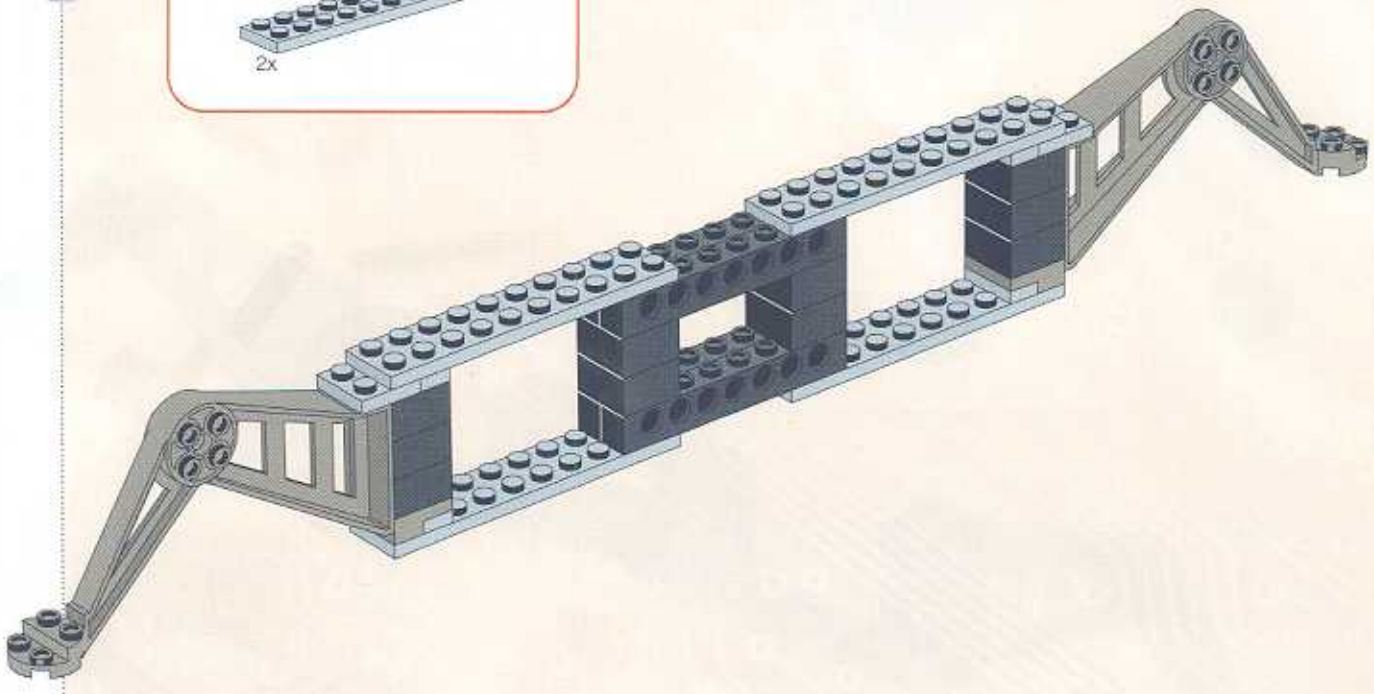

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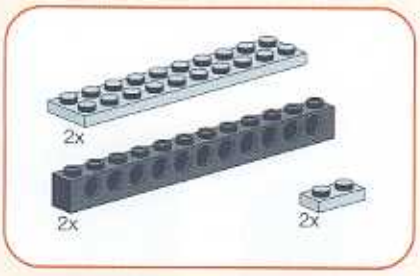

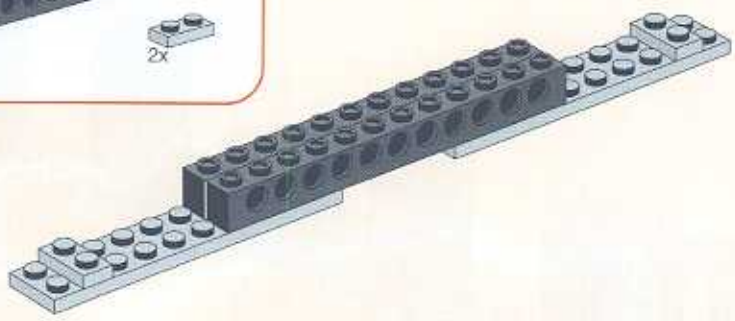

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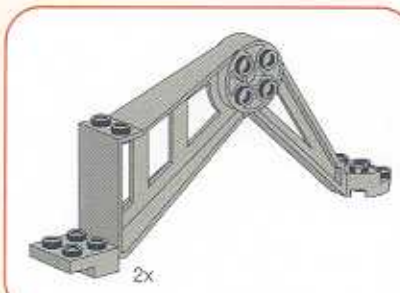

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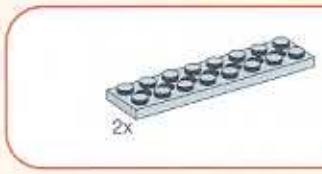

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4x
4x

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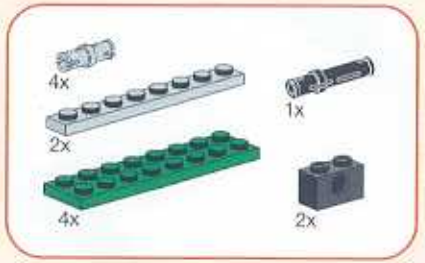

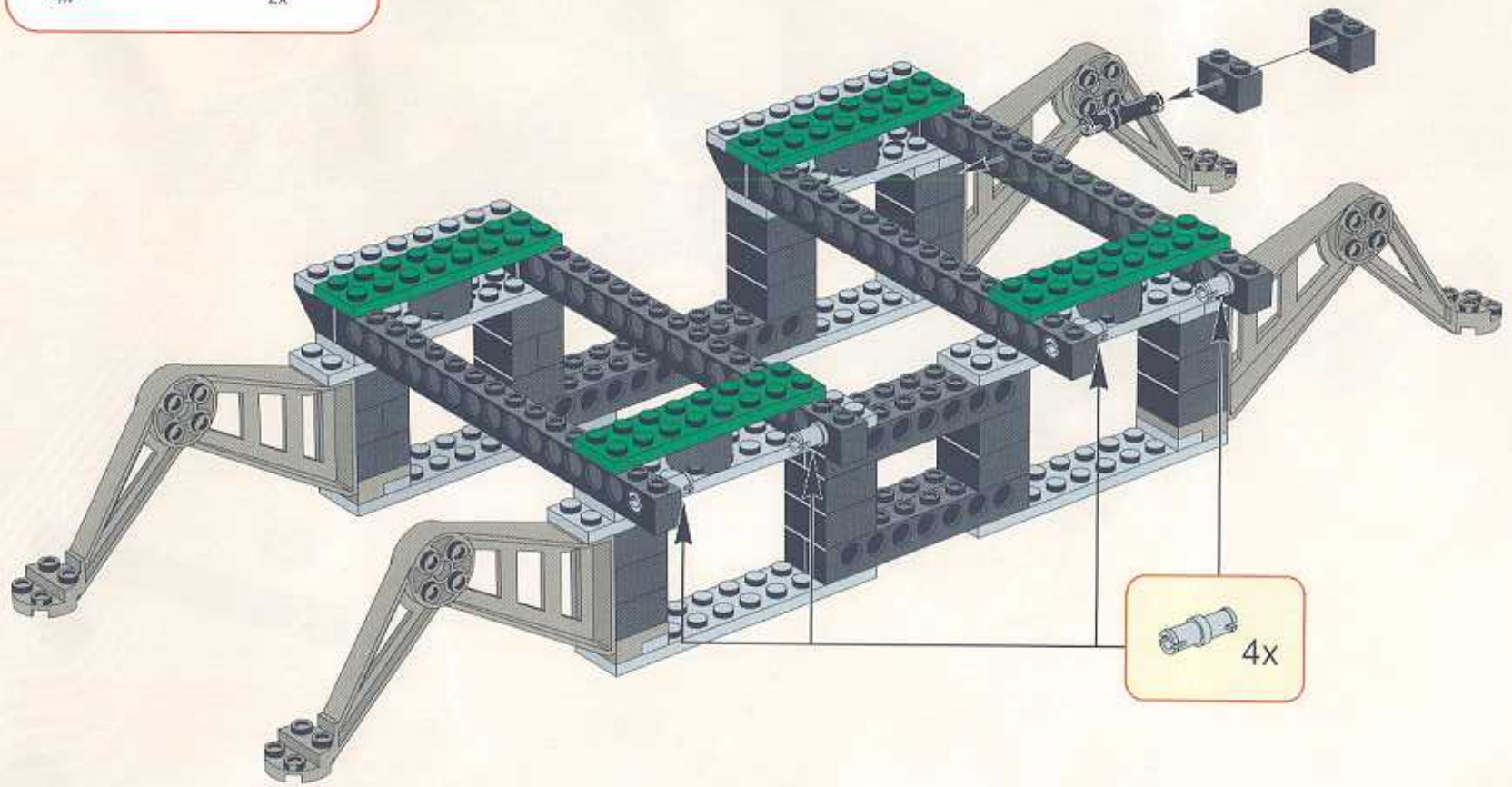

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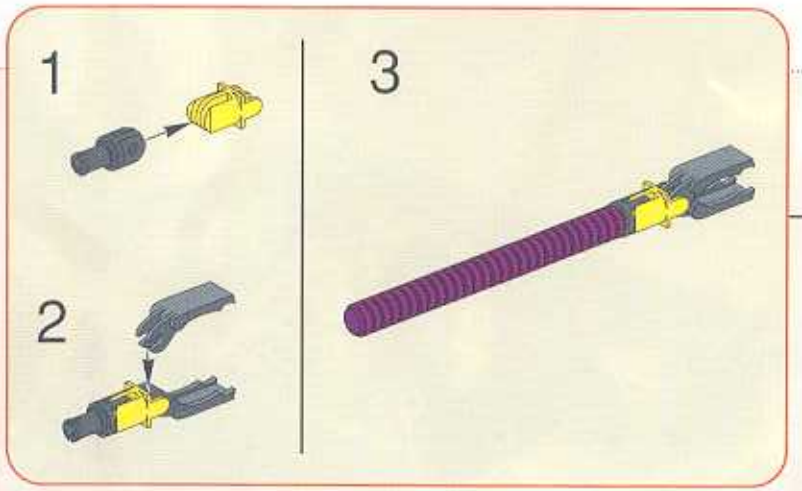
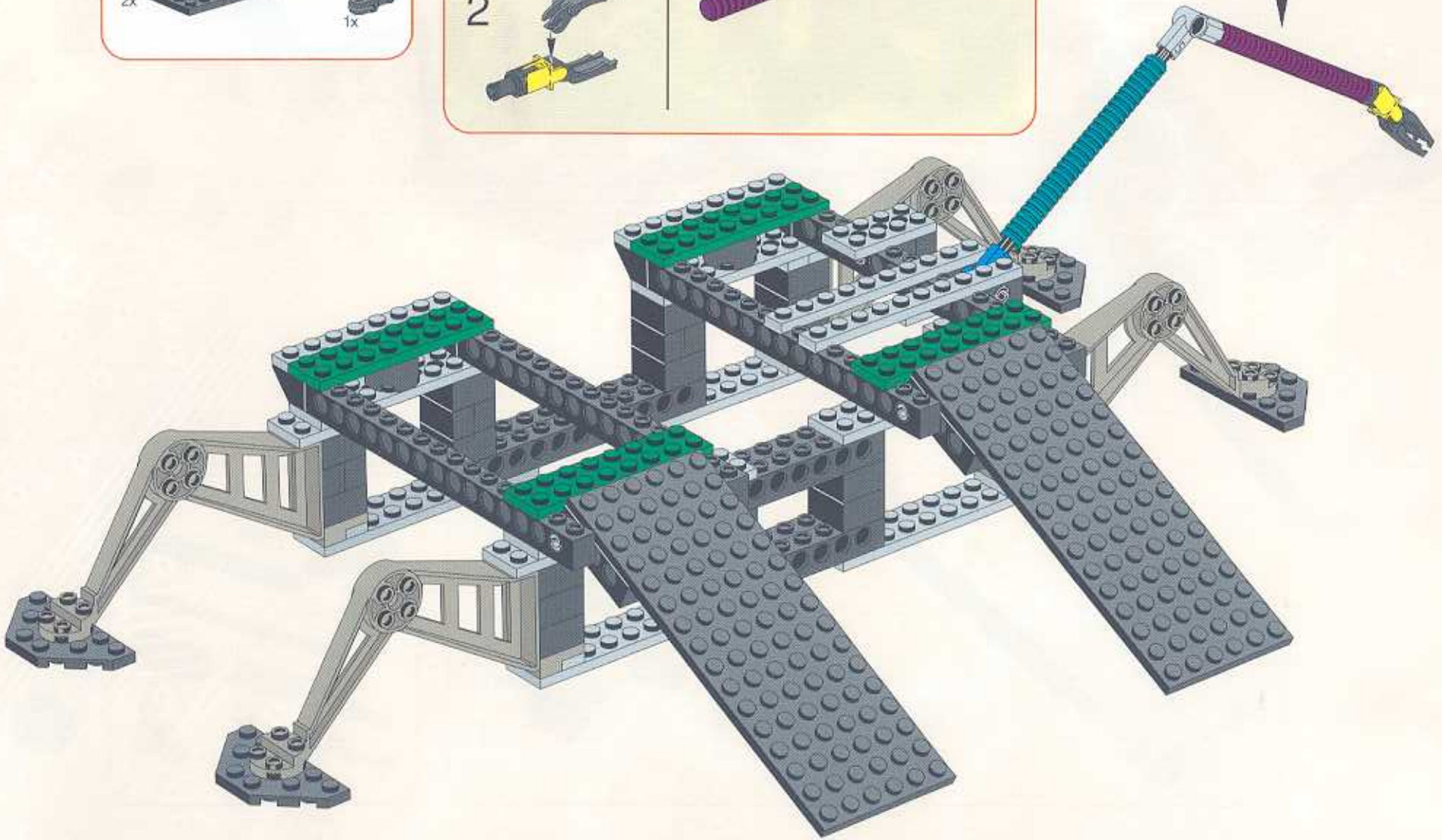
4x
1x
1x

9





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ROVER 1

The following pages show you how to build Rover 1.
Make sure that your RCX has working batteries before starting.

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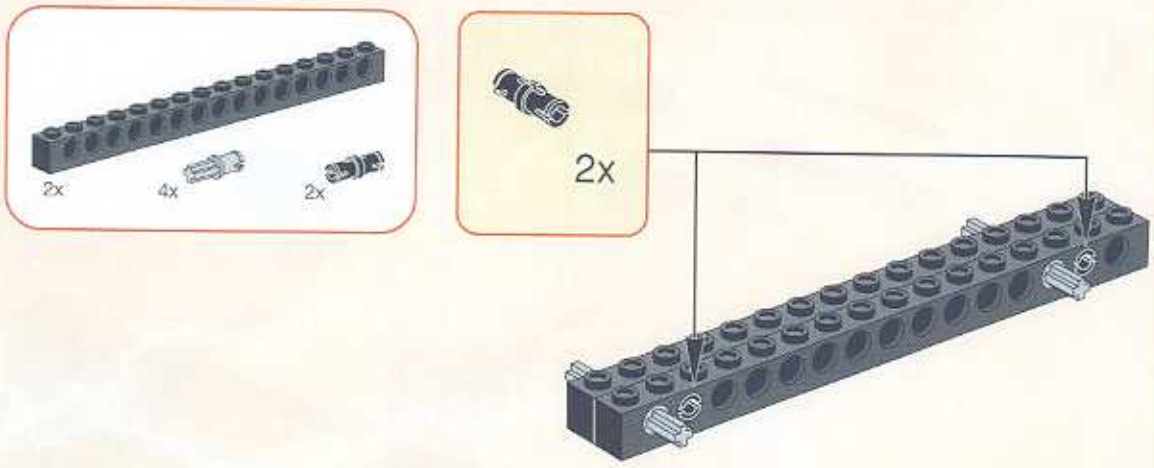

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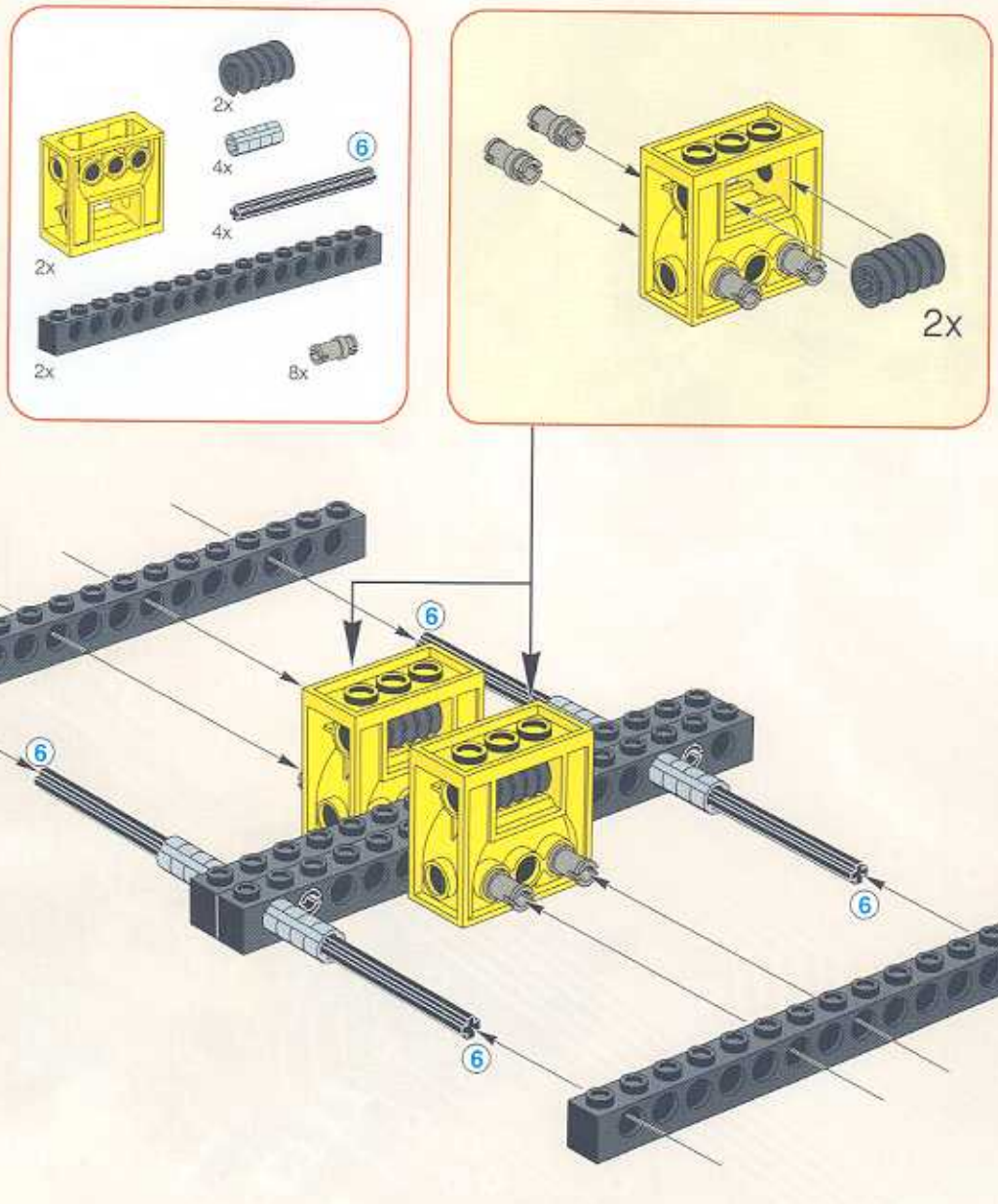

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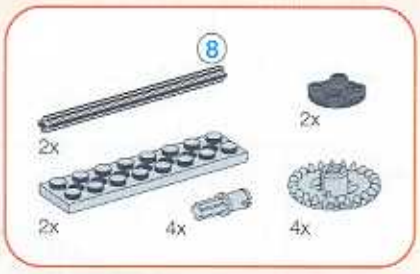

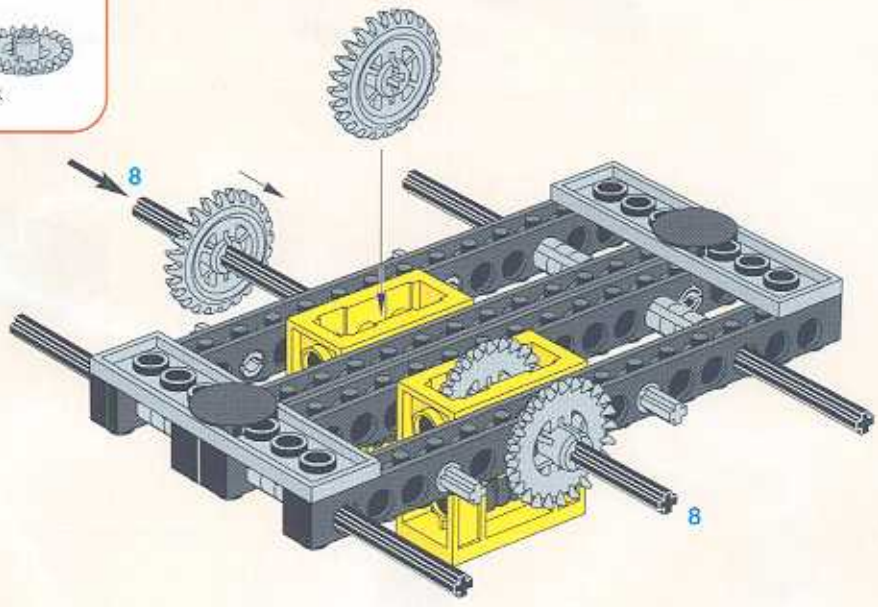

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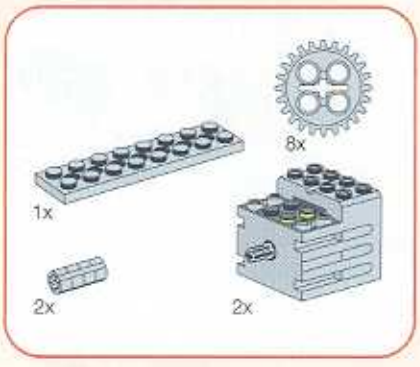

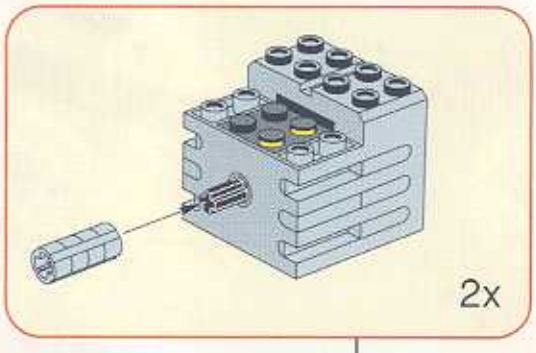

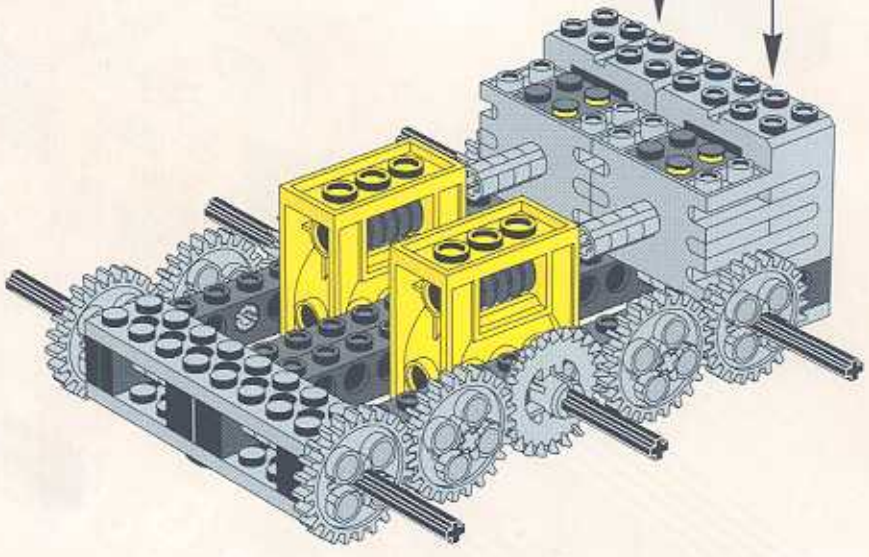

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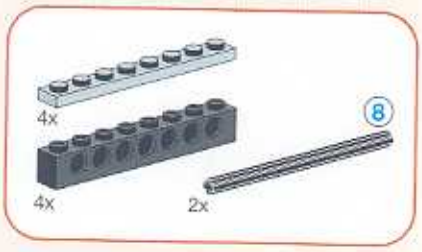

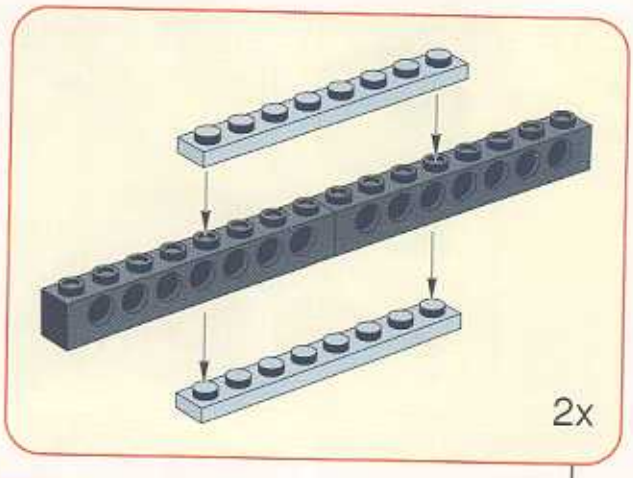

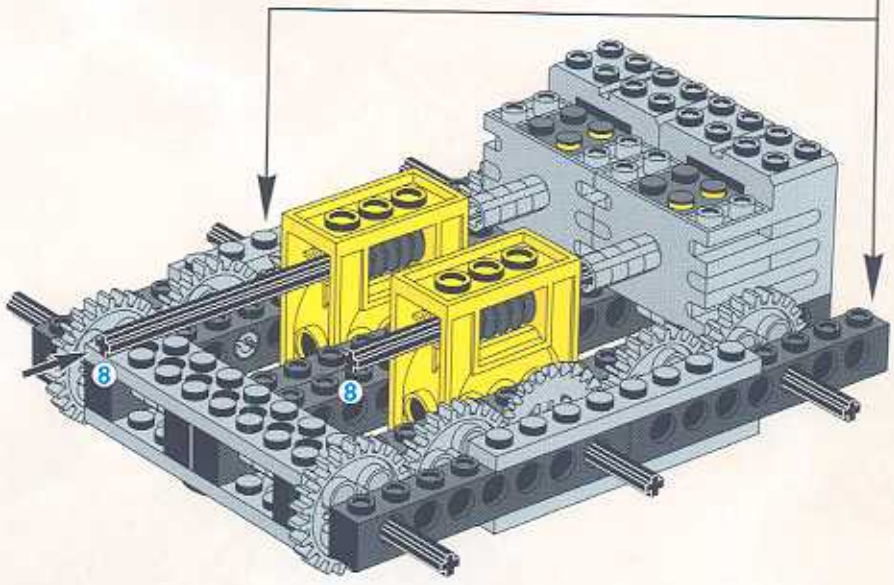

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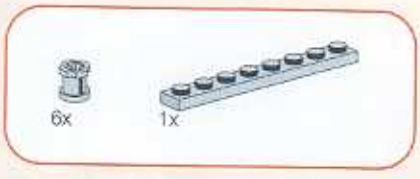

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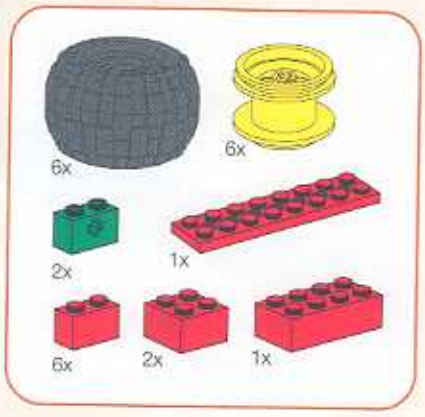

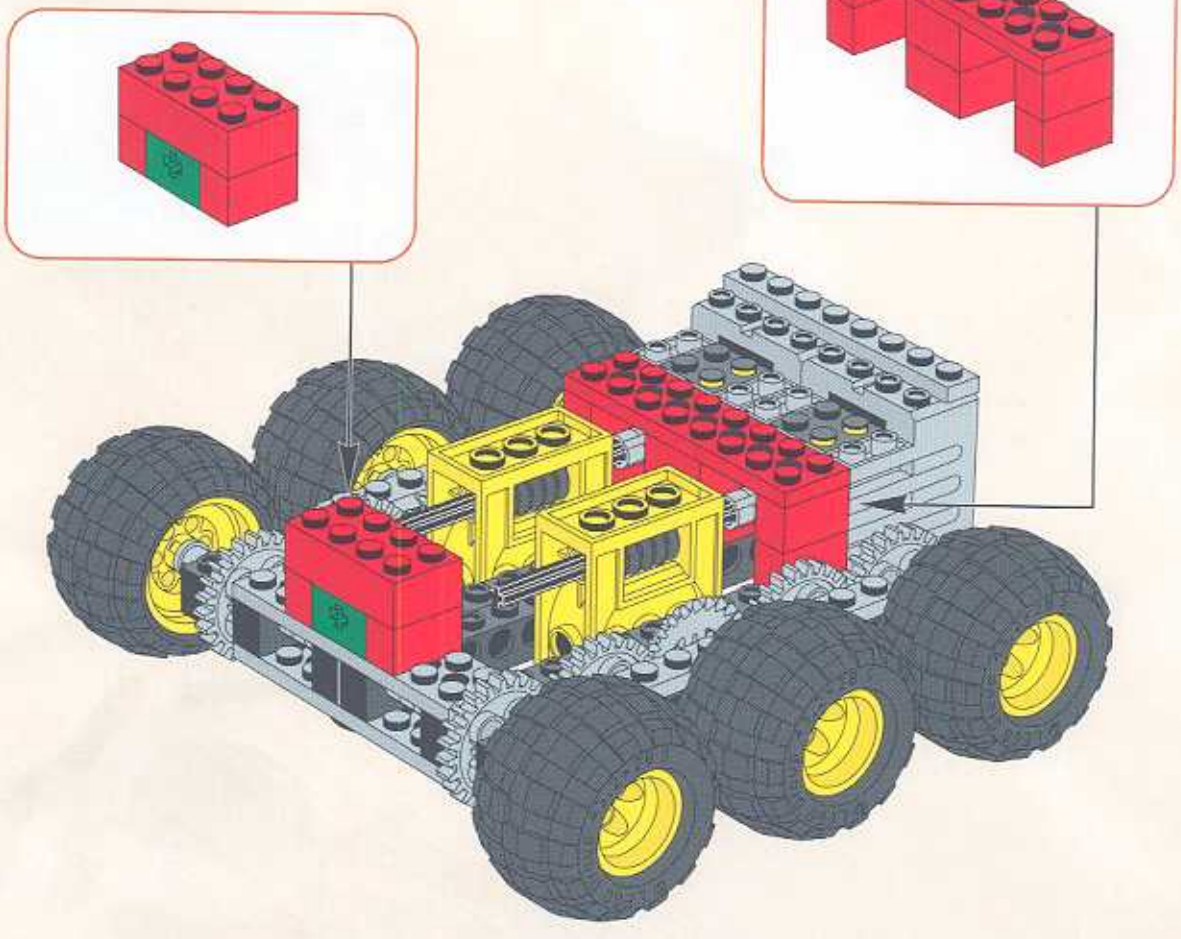

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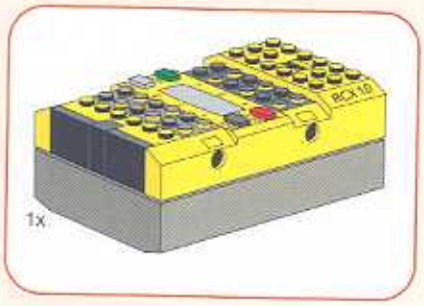

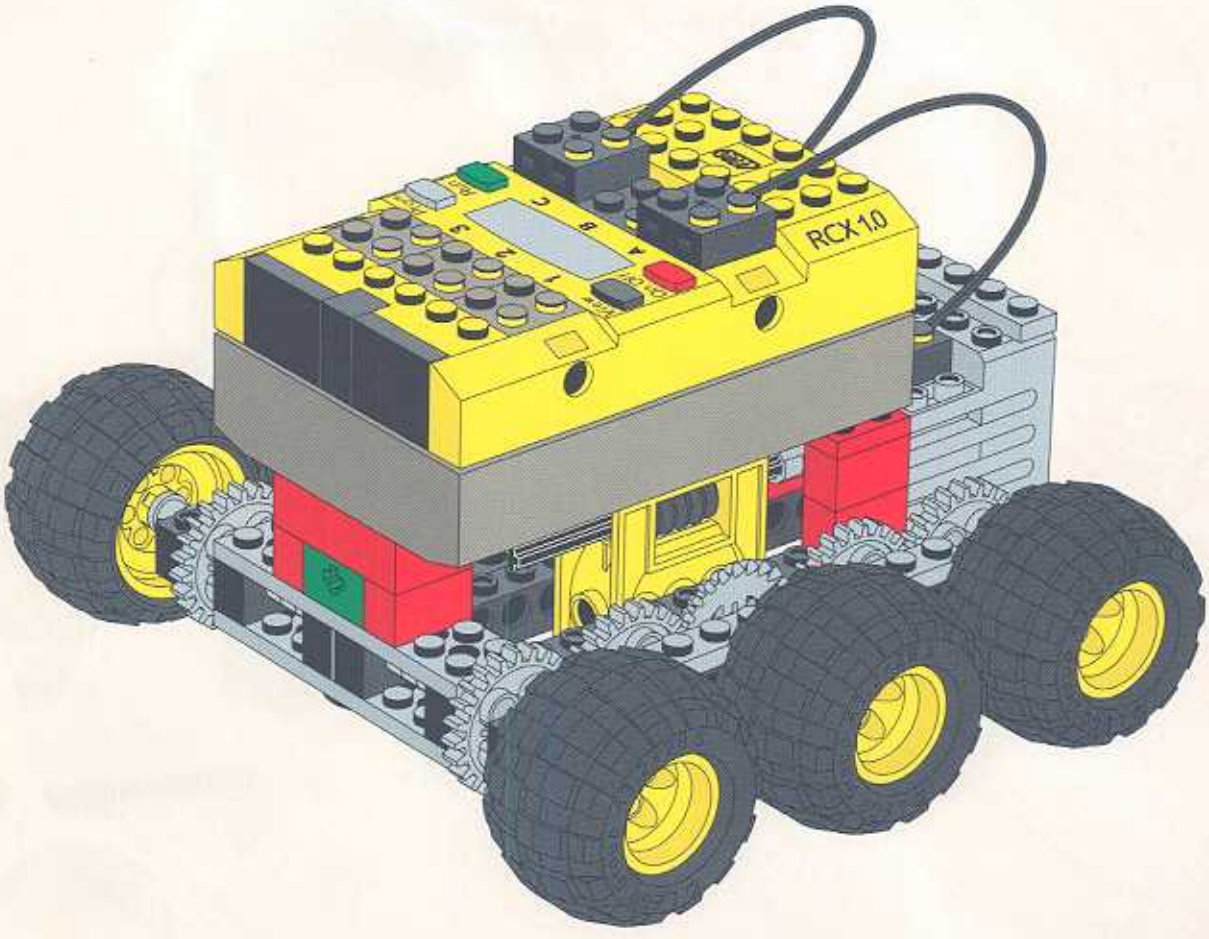

For additional ideas, go to page 40.

ROVER 2

The following pages show you how to build Rover 2.
Make sure that your RCX has working batteries before starting.

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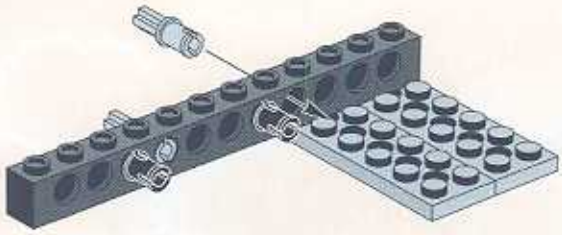

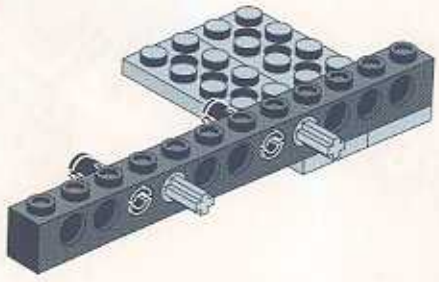

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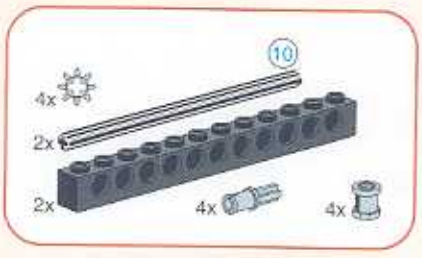

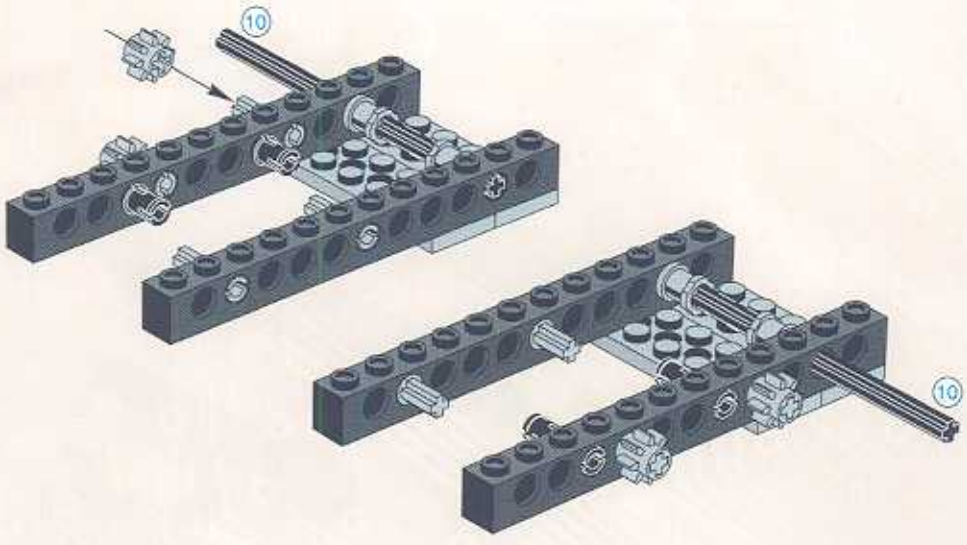

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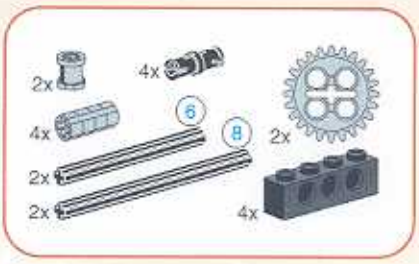

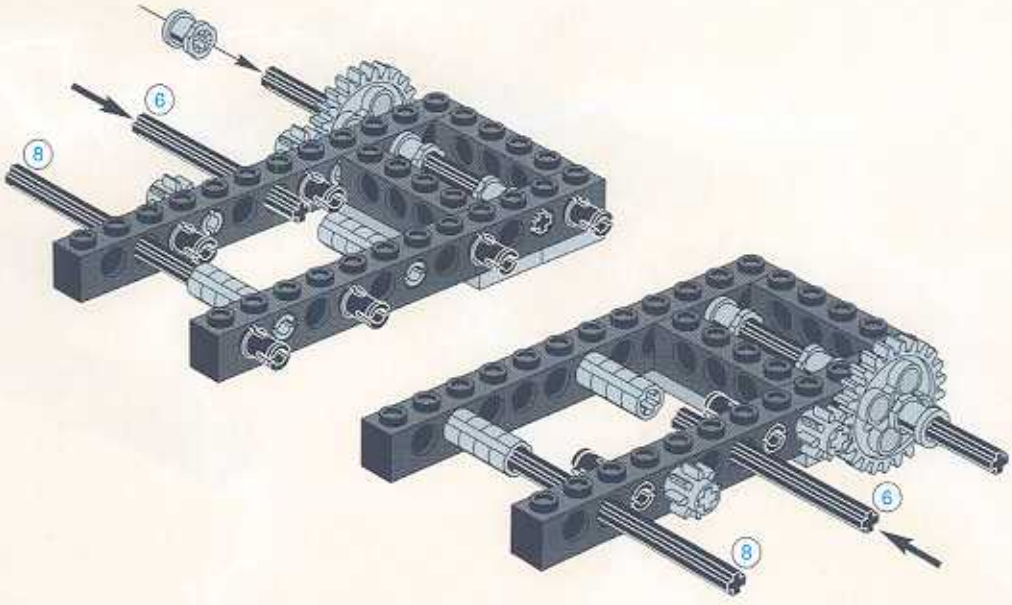

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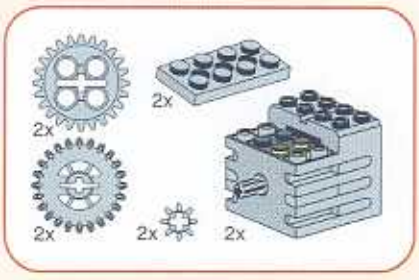

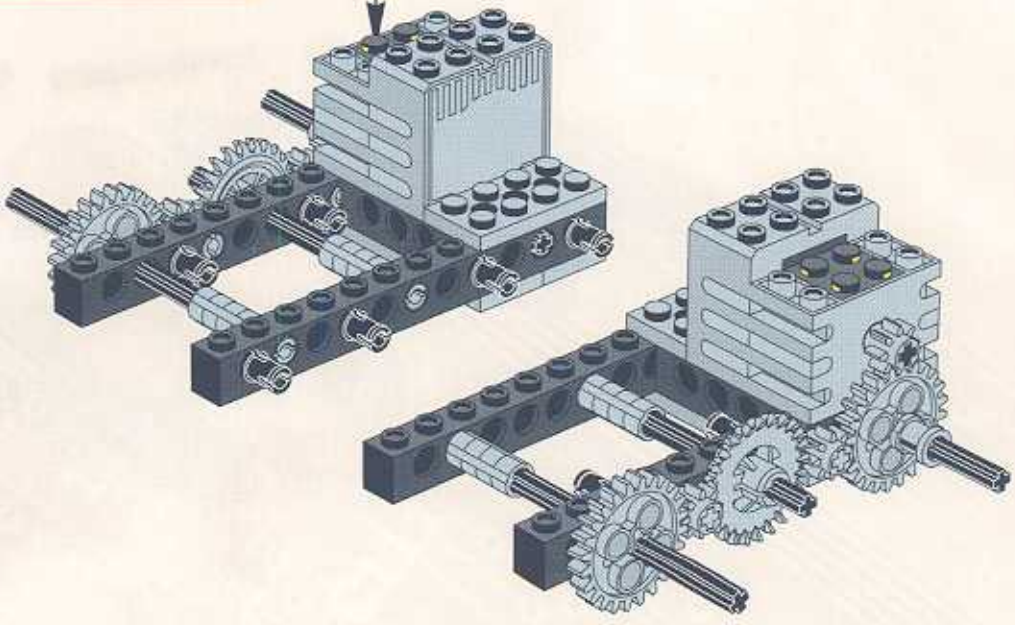

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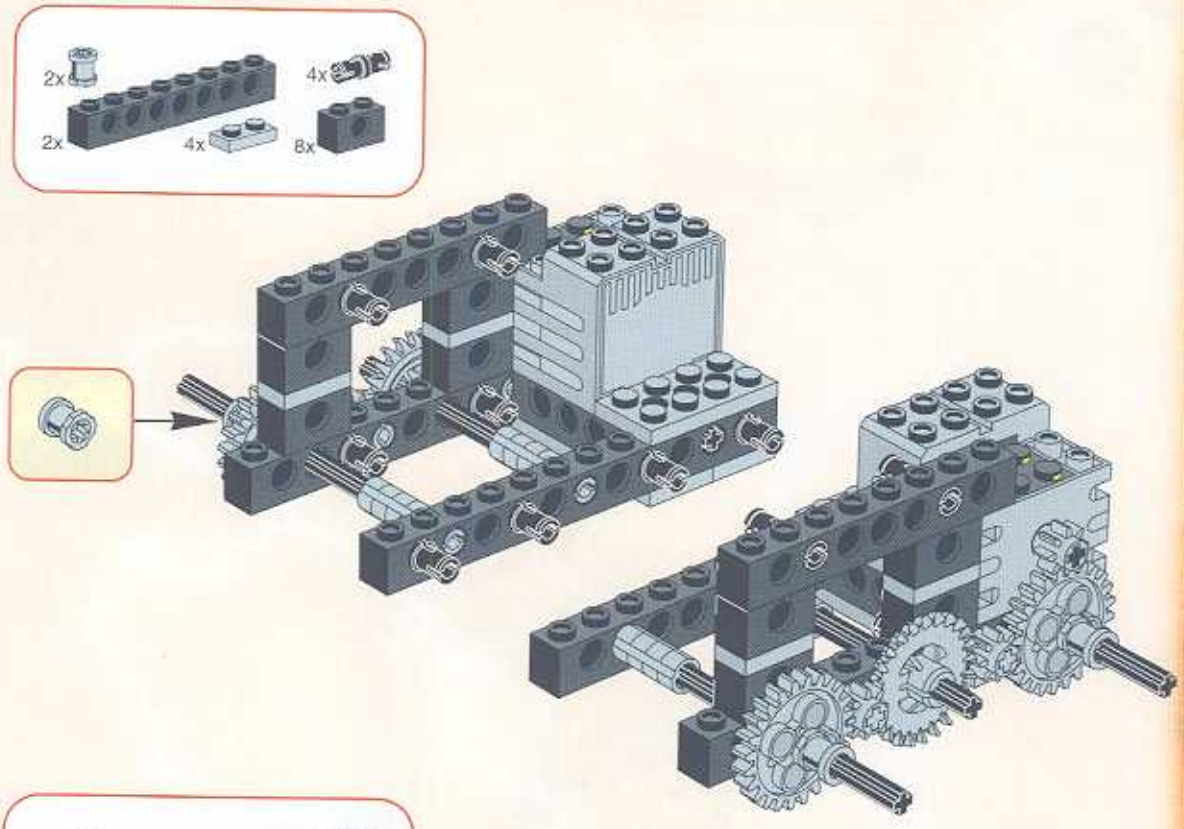

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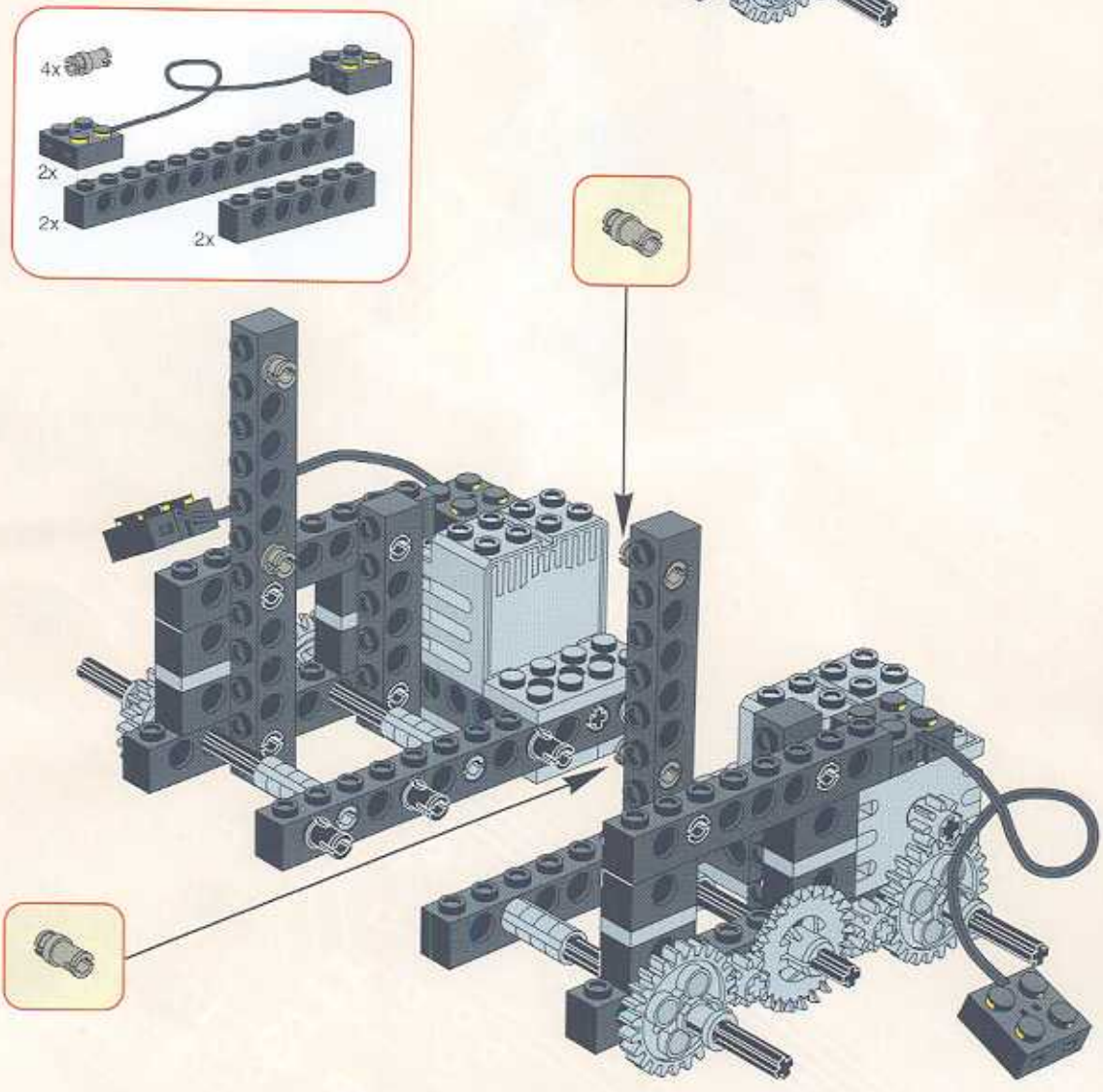

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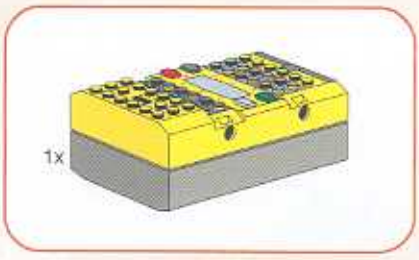

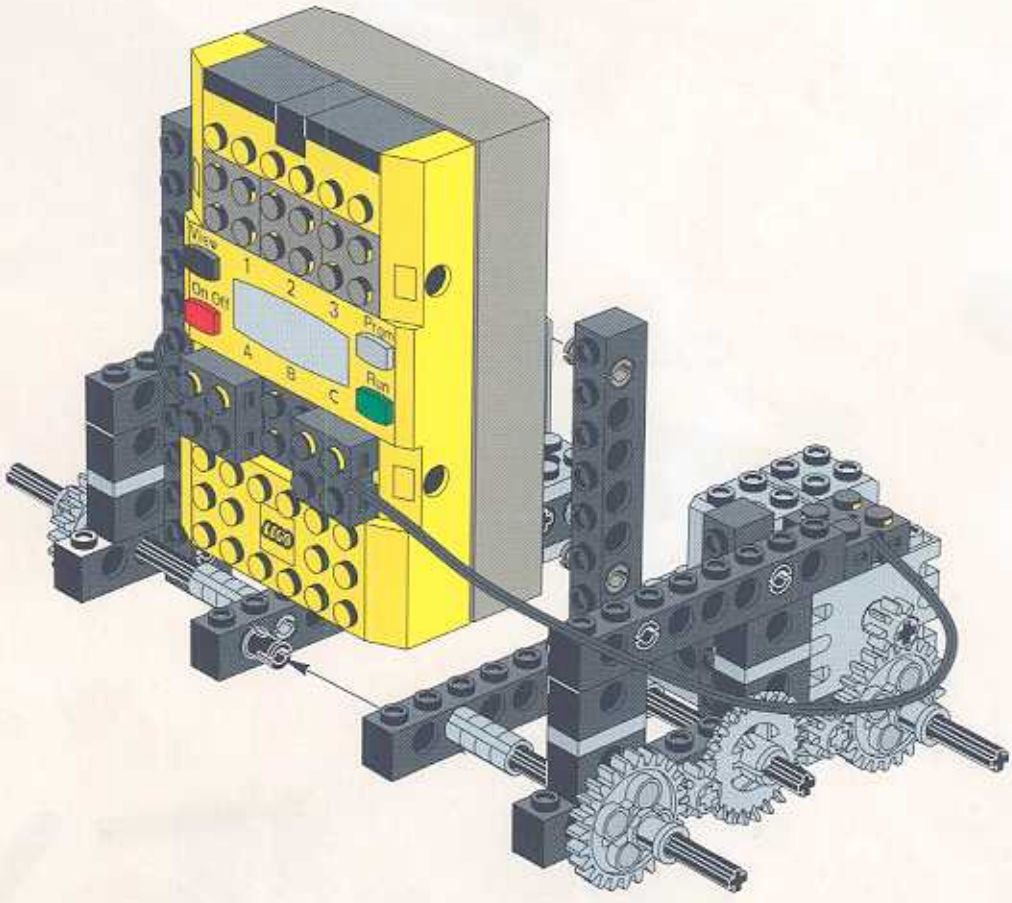

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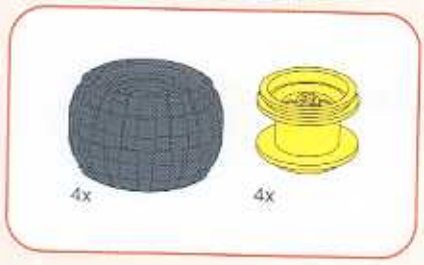
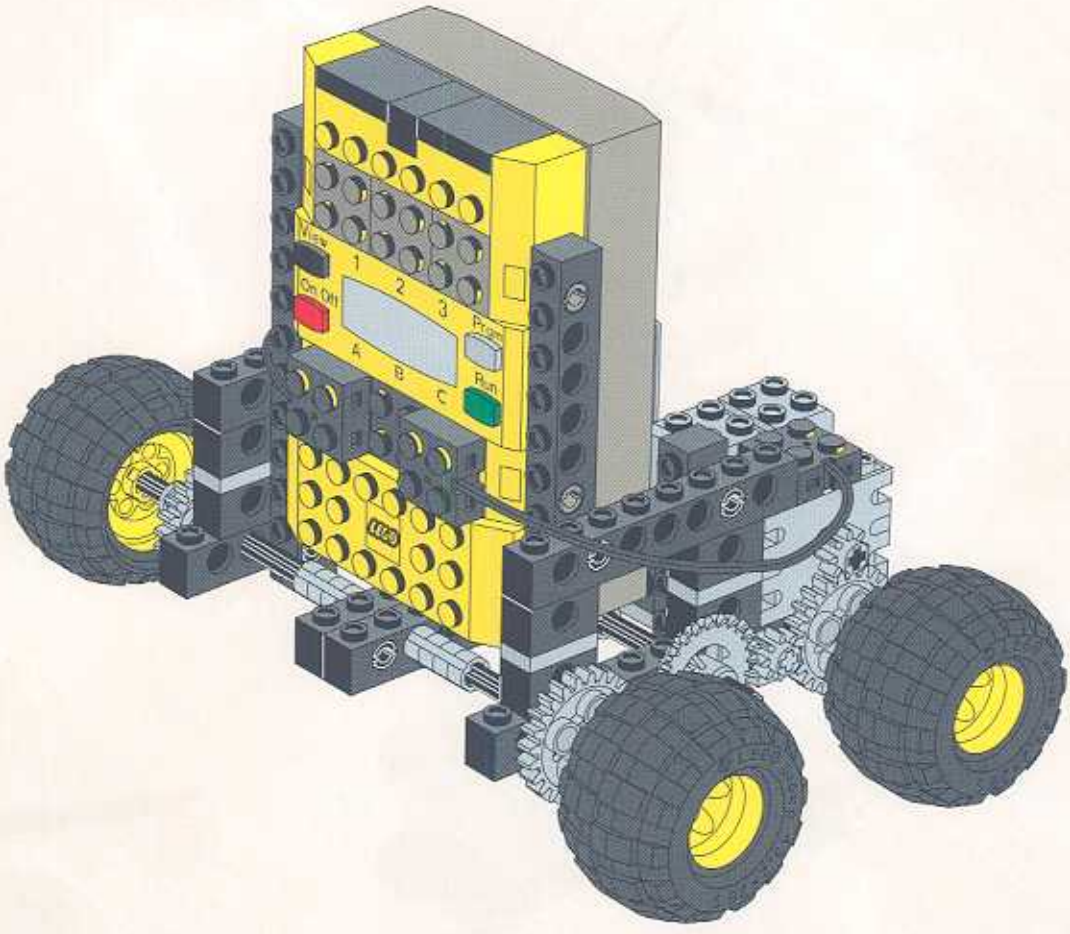
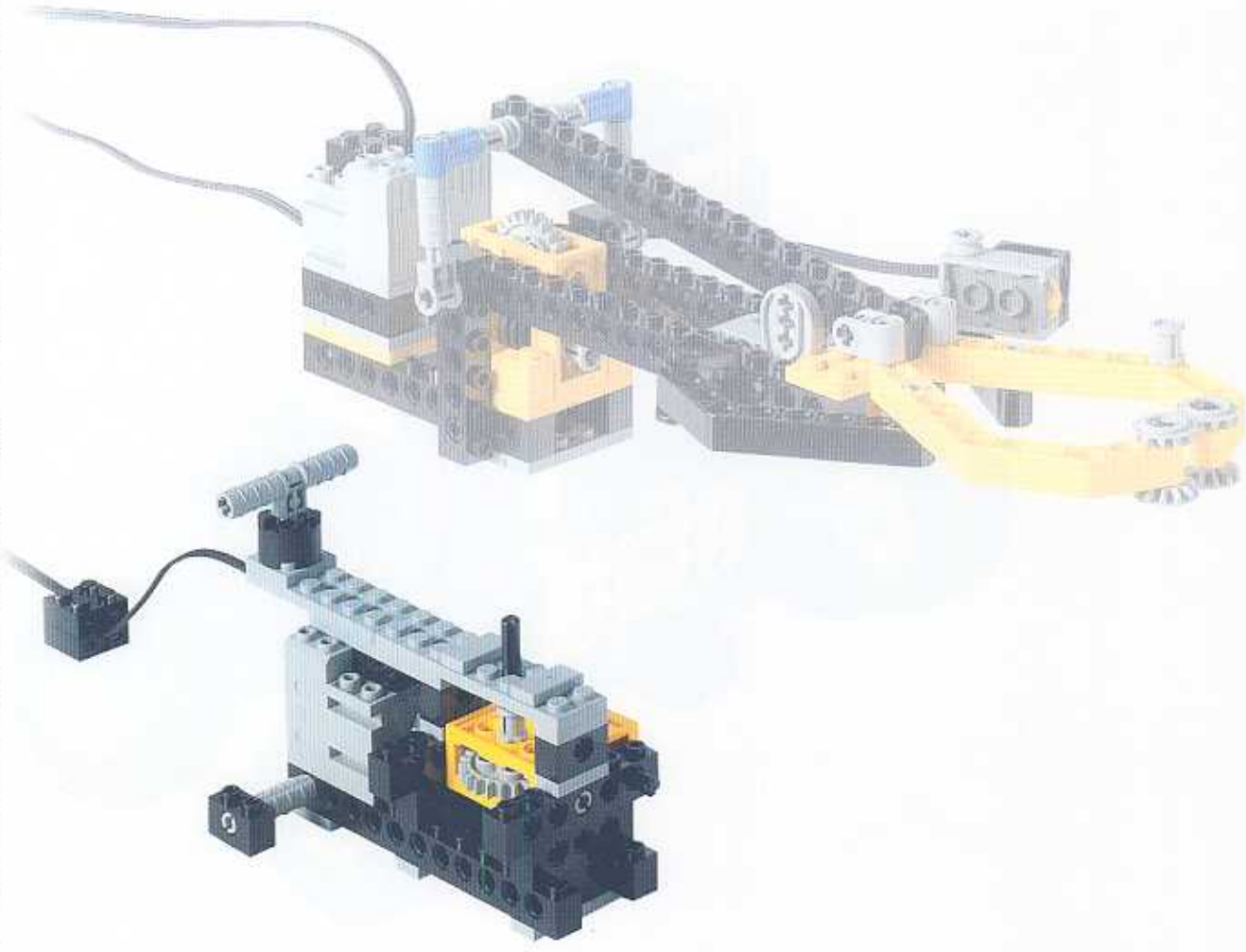




TURNTABLE

The following pages show you how to build the Turntable.



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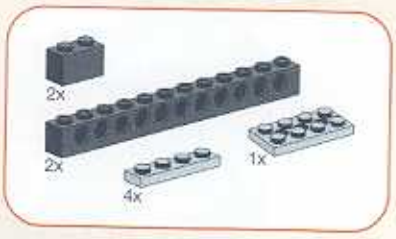

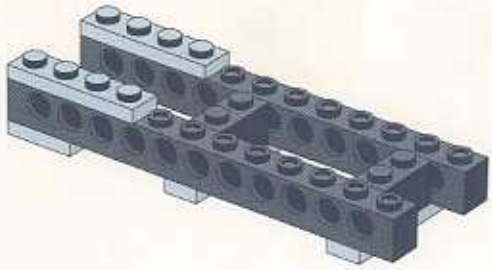

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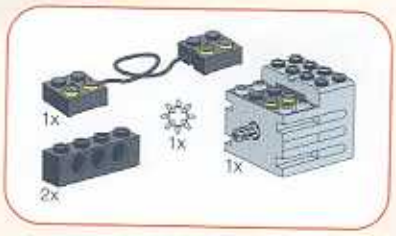

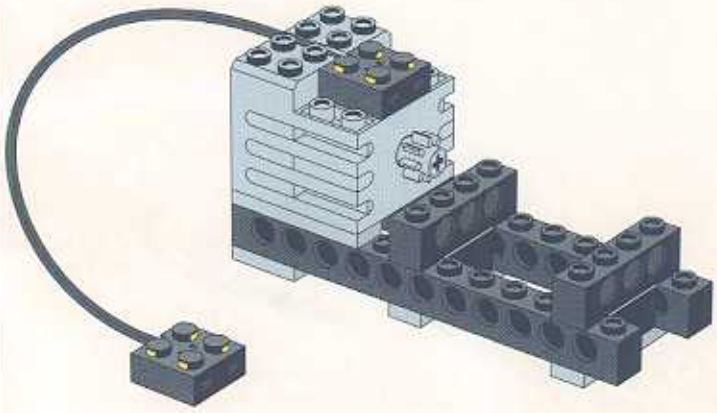

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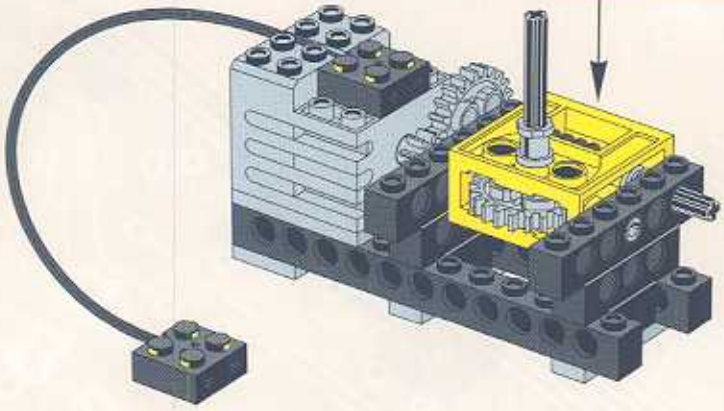

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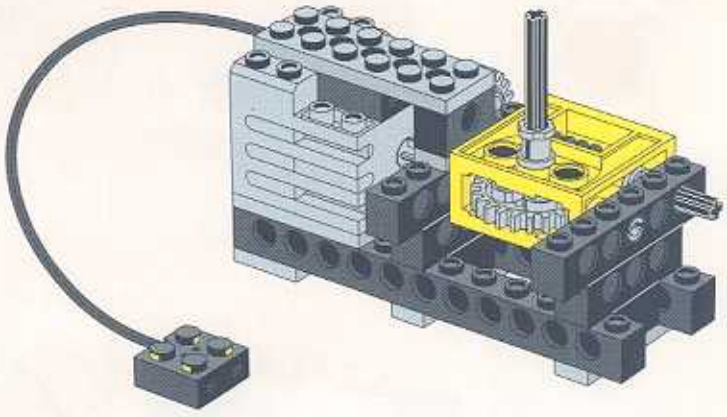

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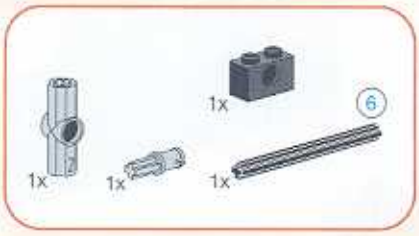

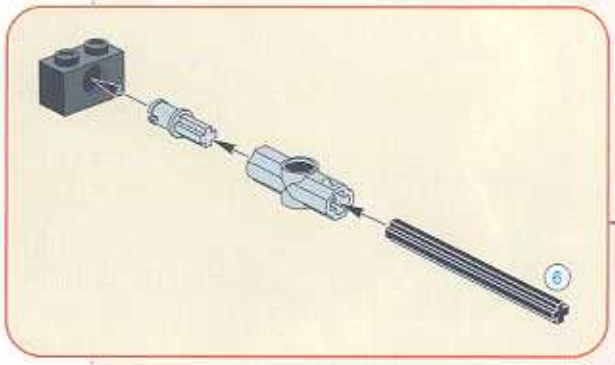

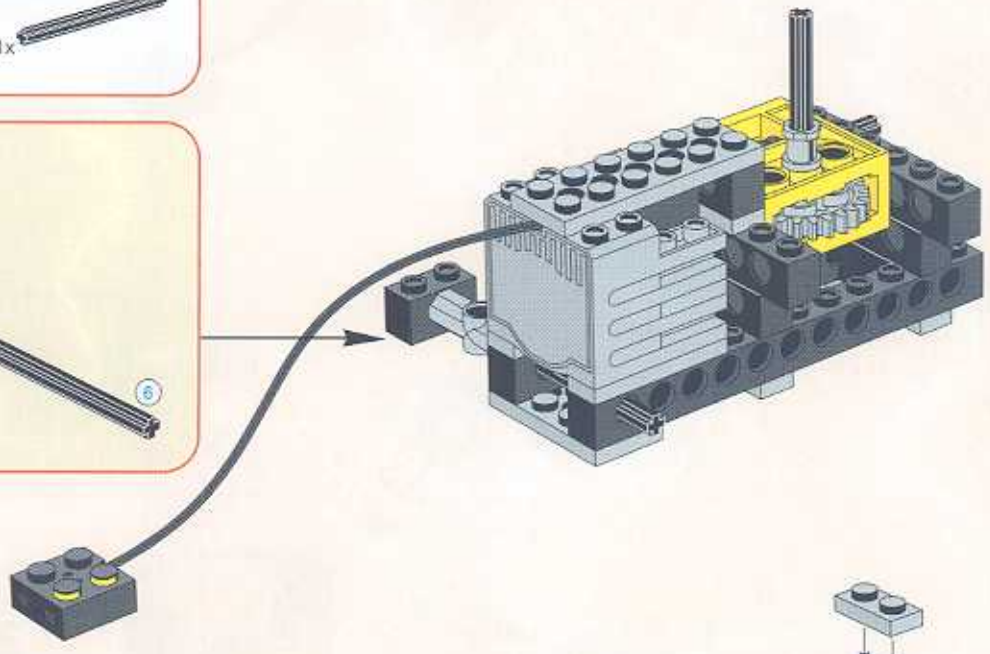

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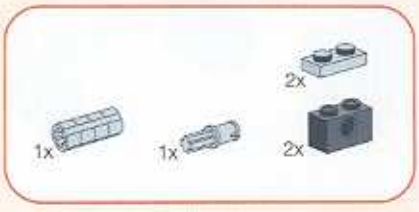

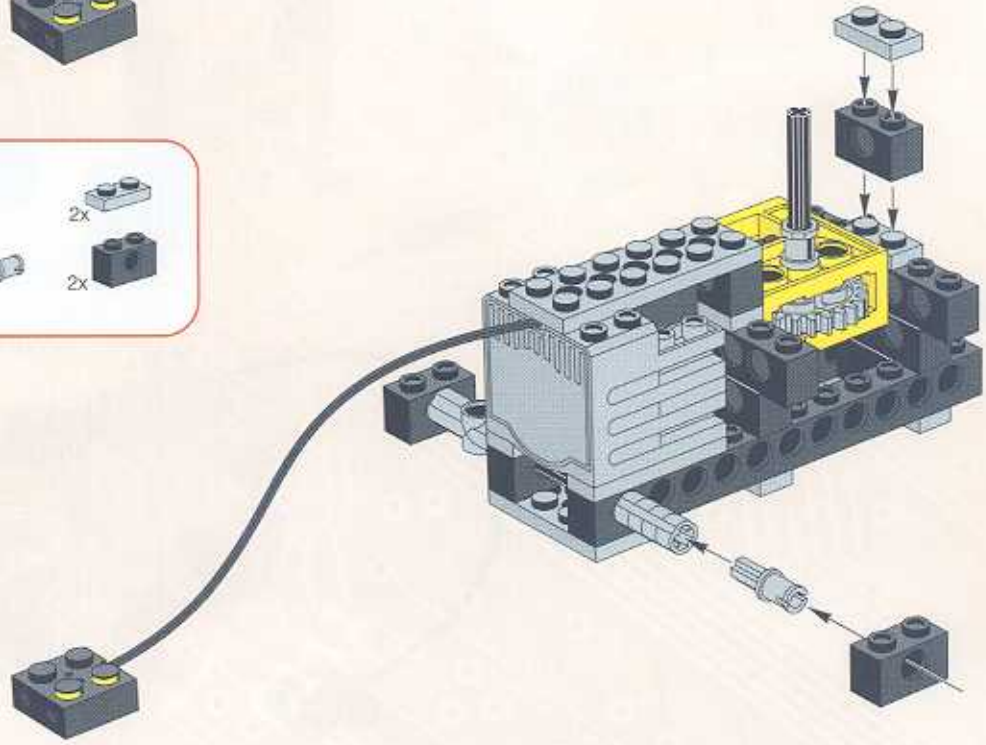

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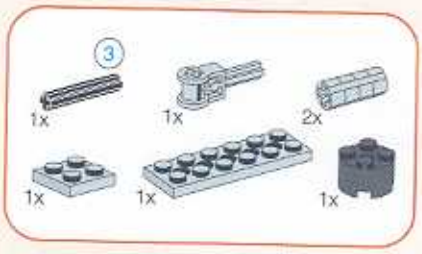

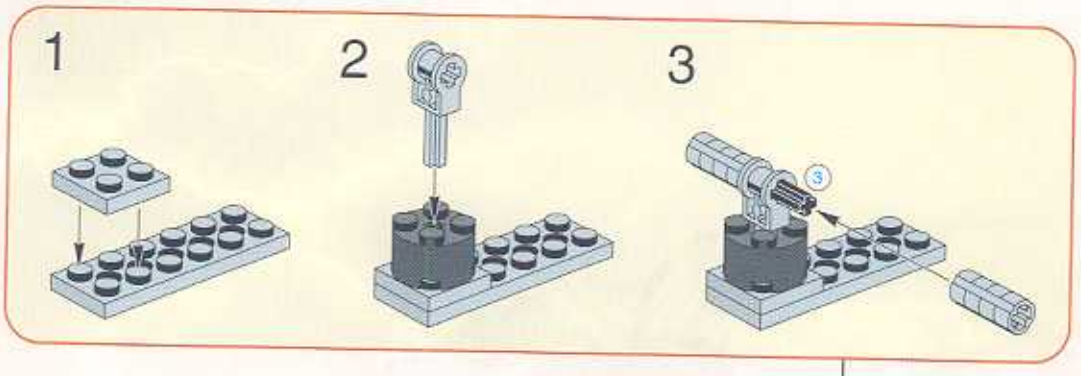

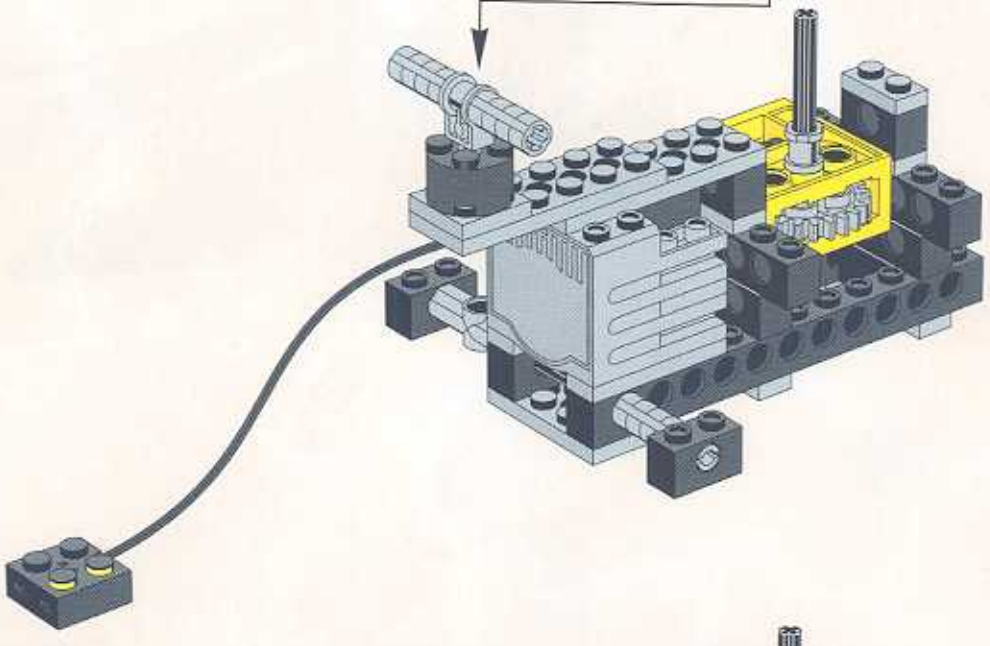

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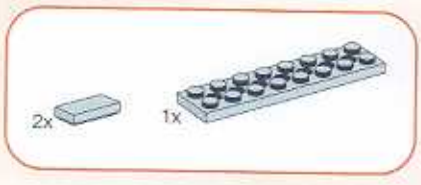
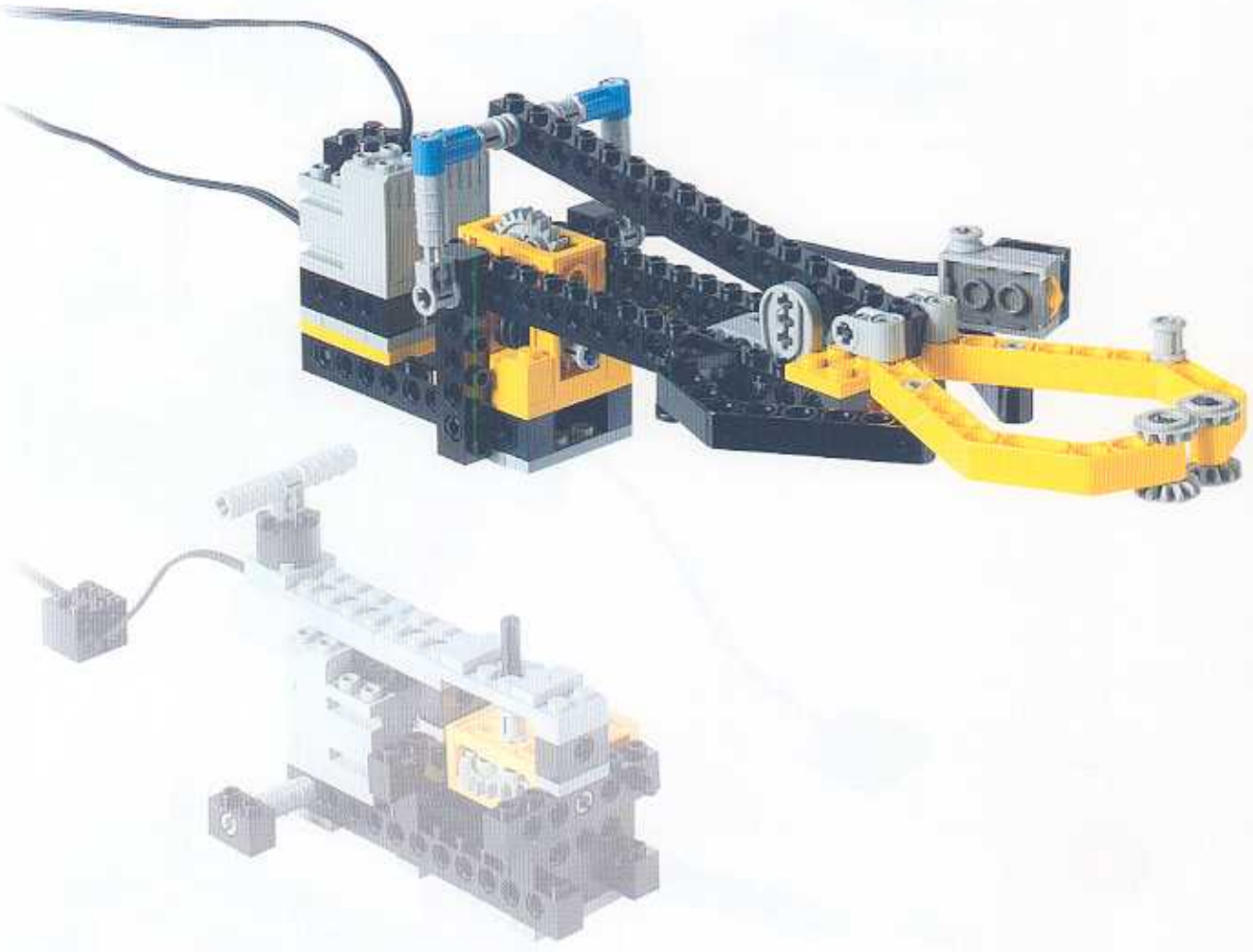


ROBOTIC ARM

The following pages show you how to build the Robotic Arm. The Robotic Arm is placed on top of the Turntable.



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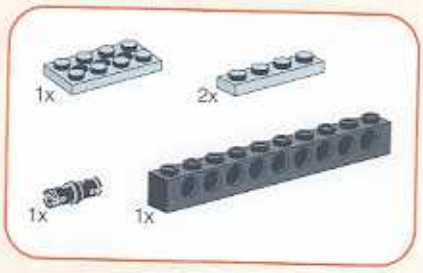

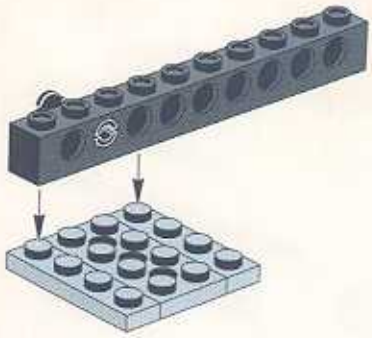

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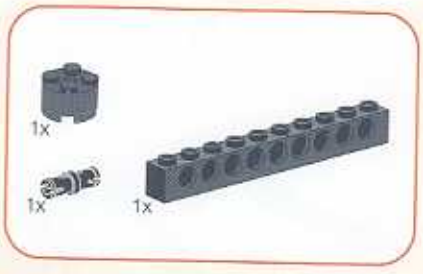

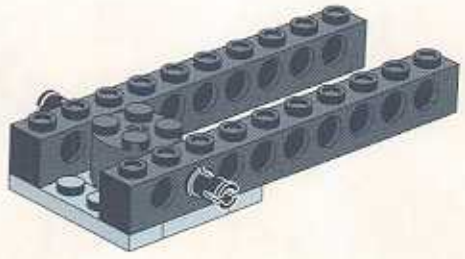

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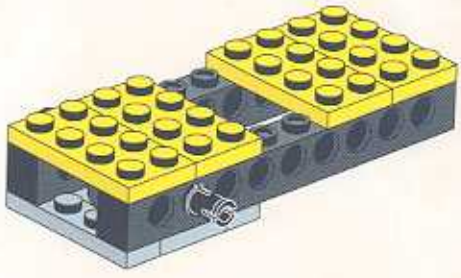

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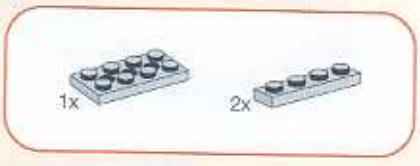

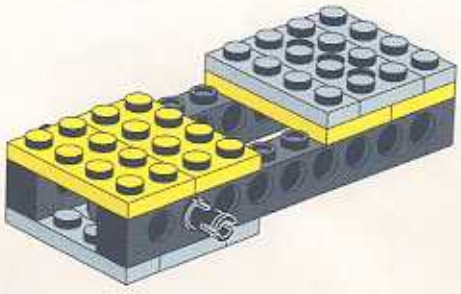

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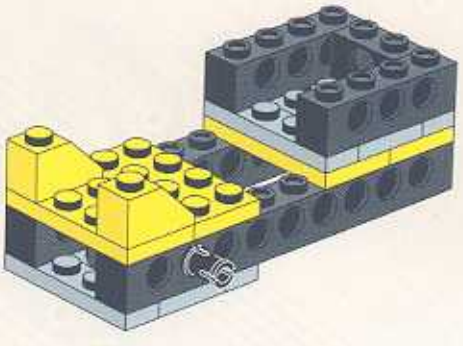

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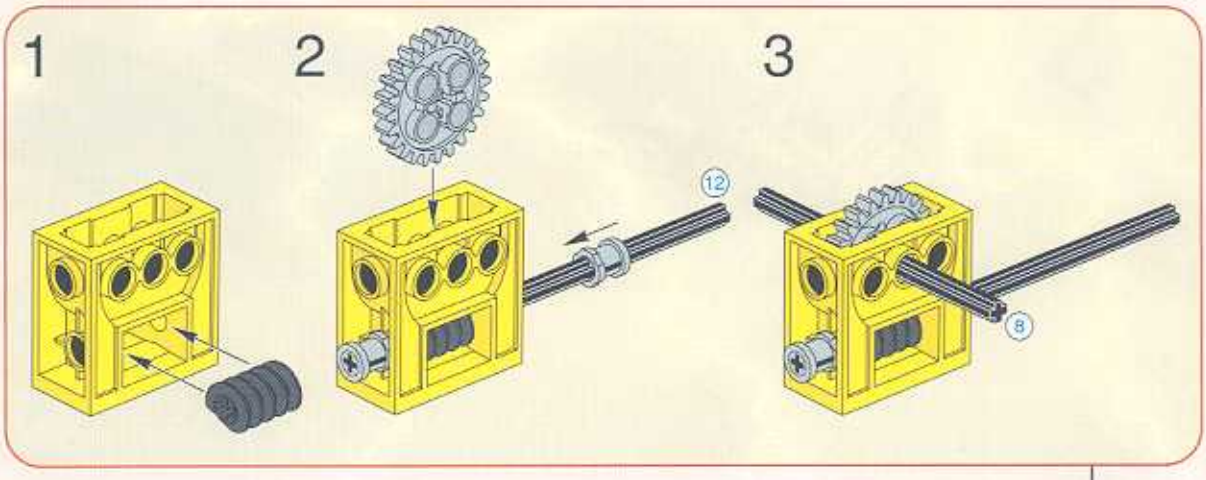

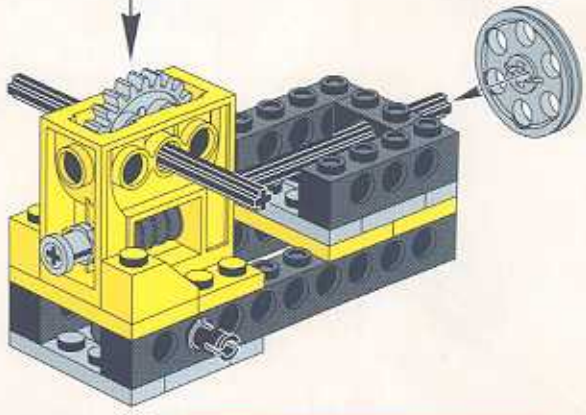

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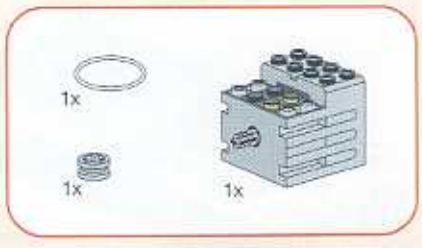

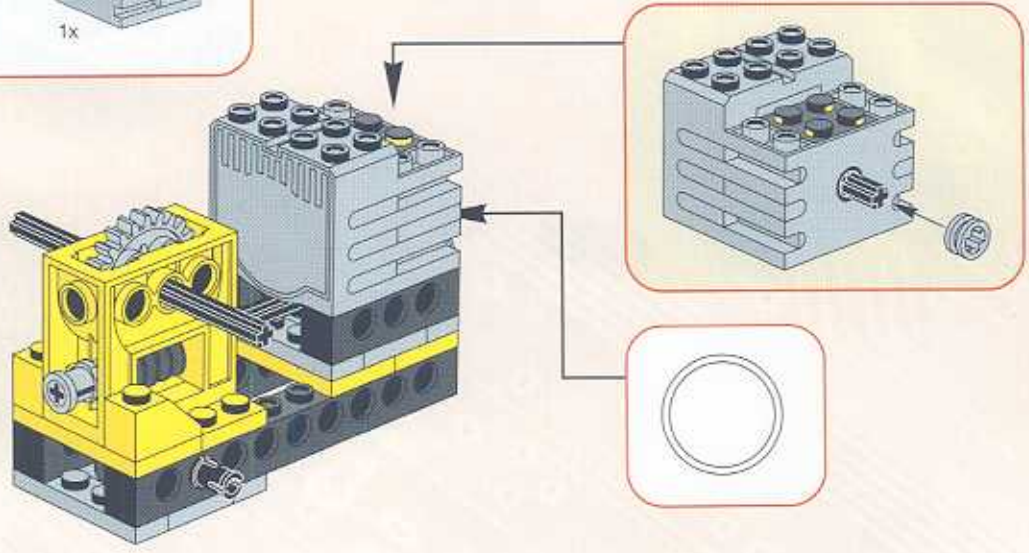

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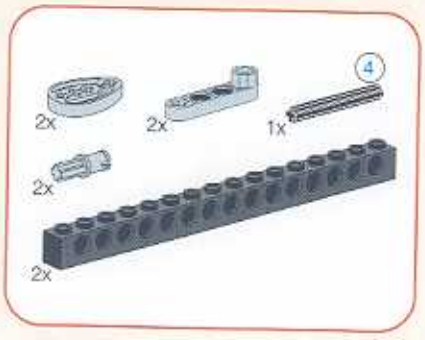

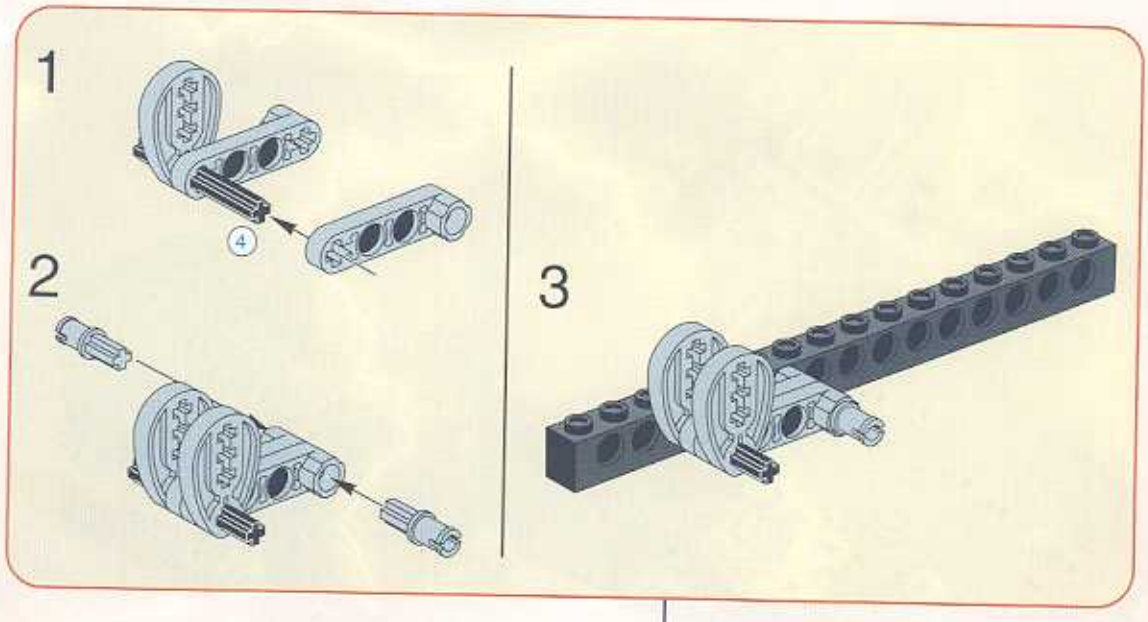

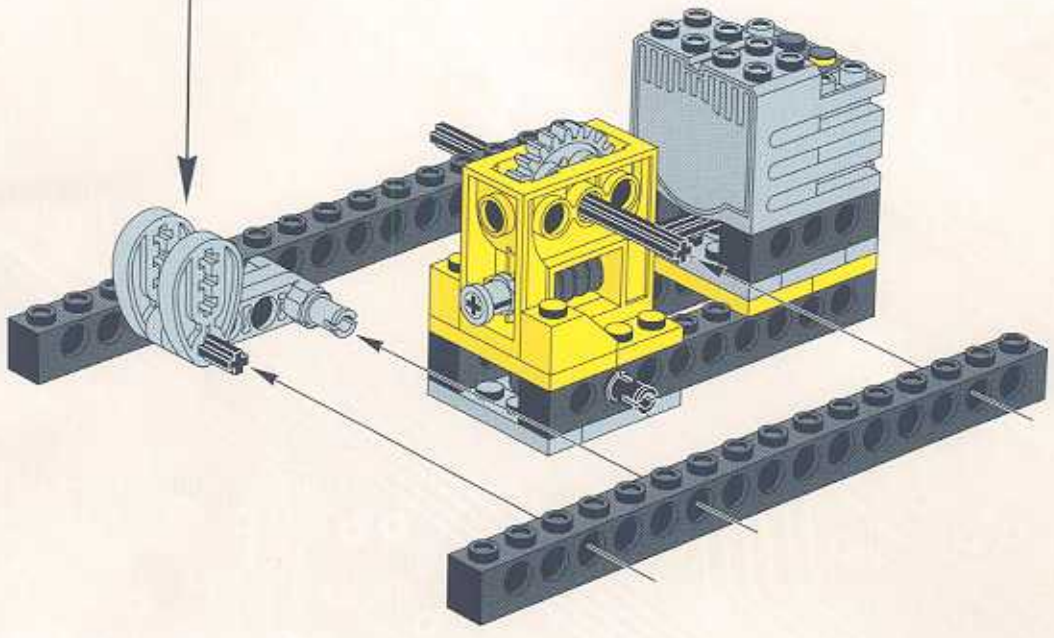

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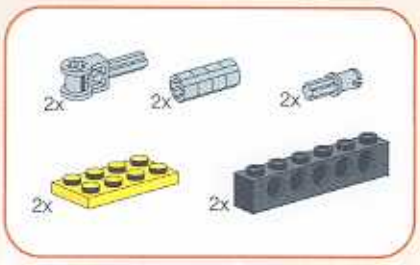

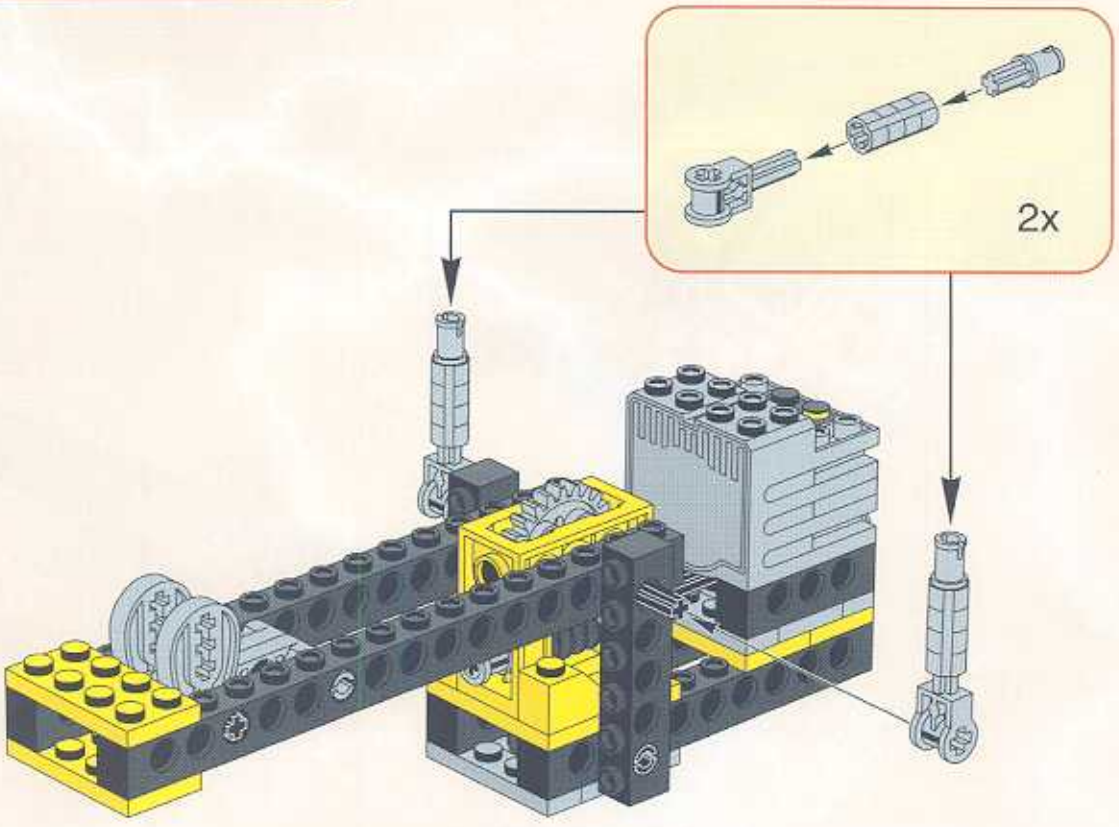

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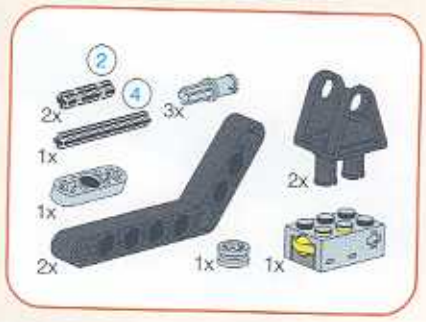

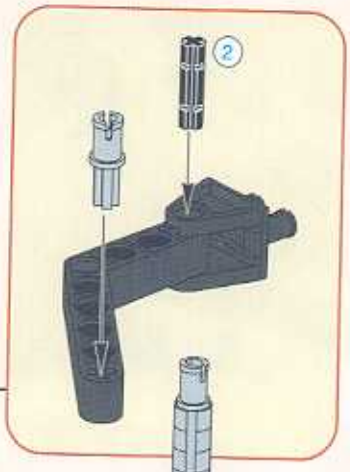

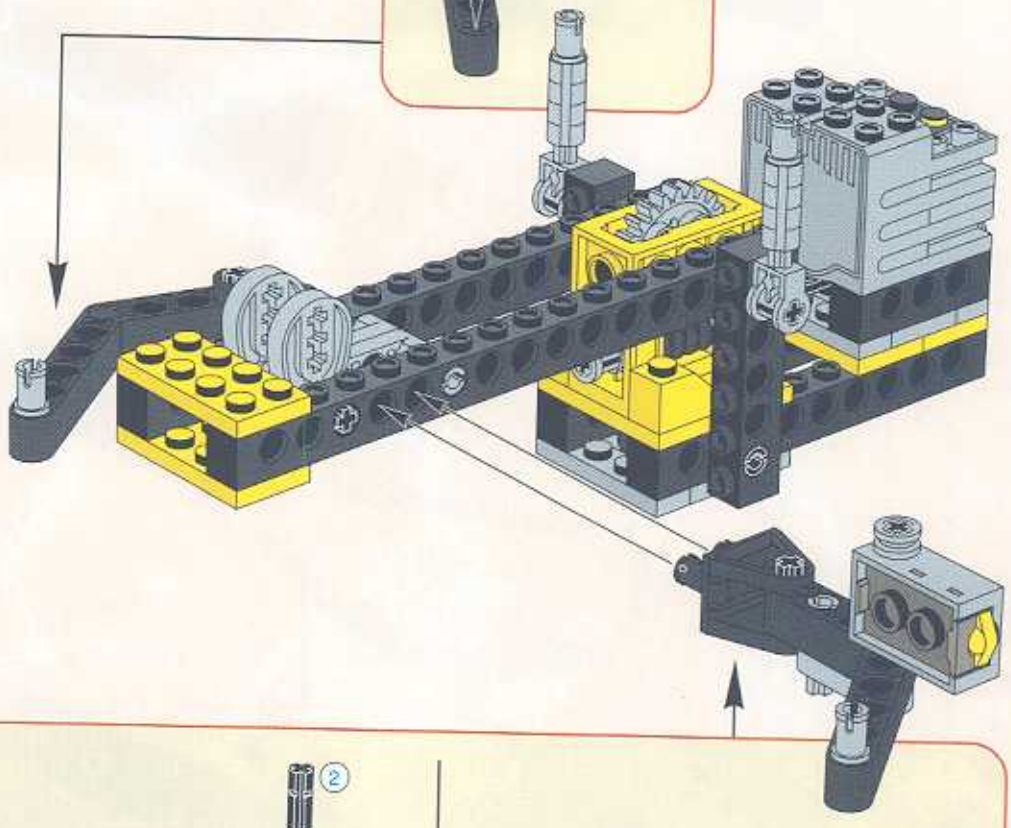

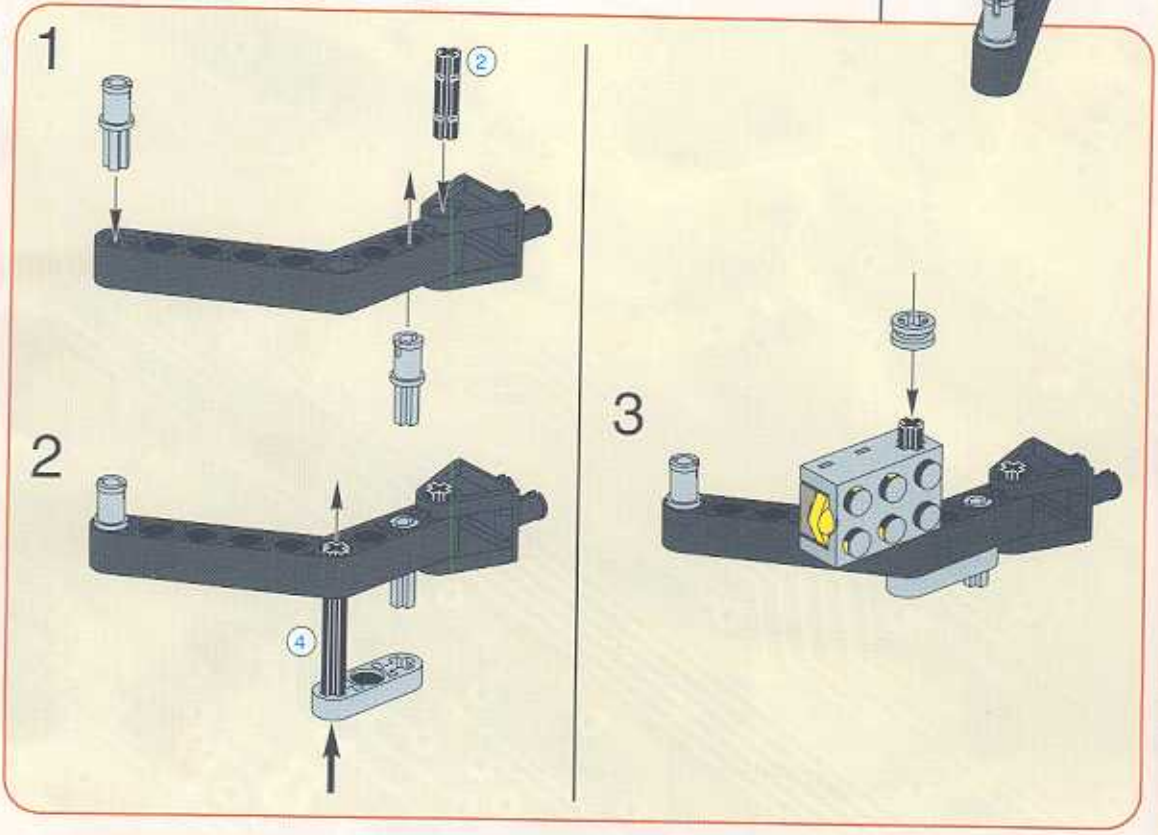

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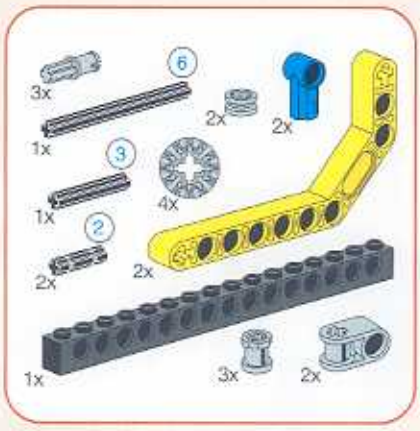
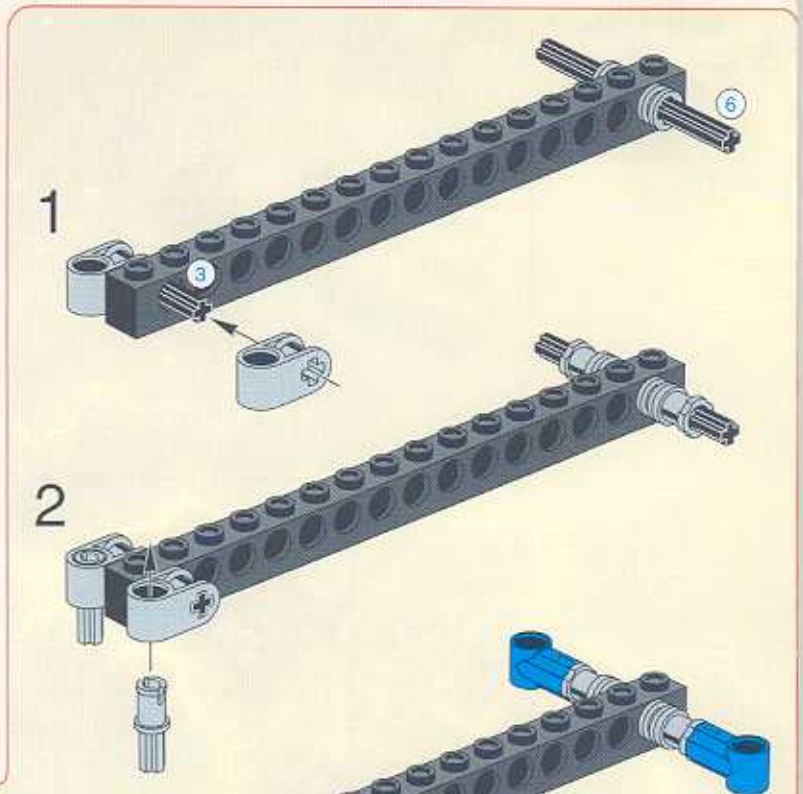
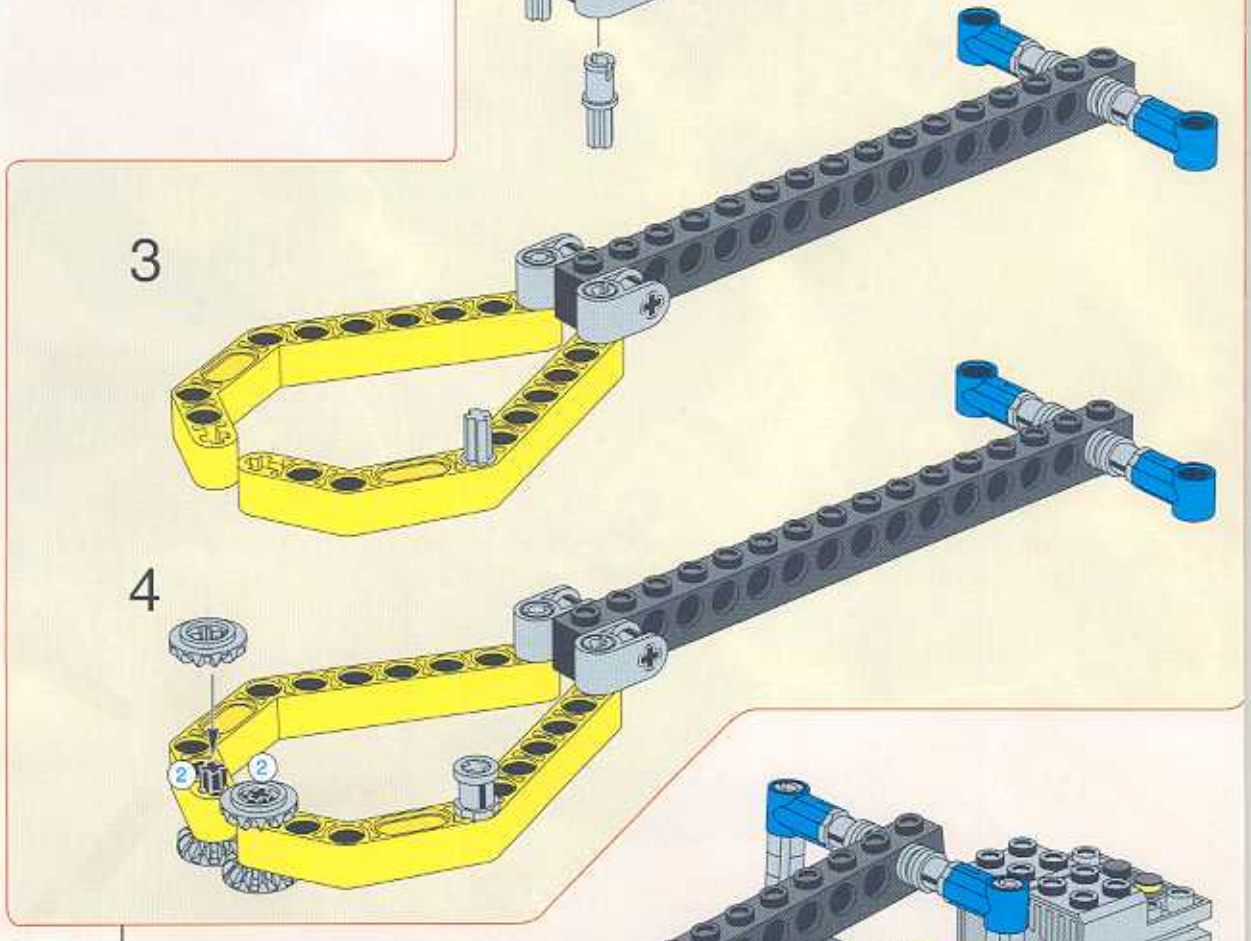
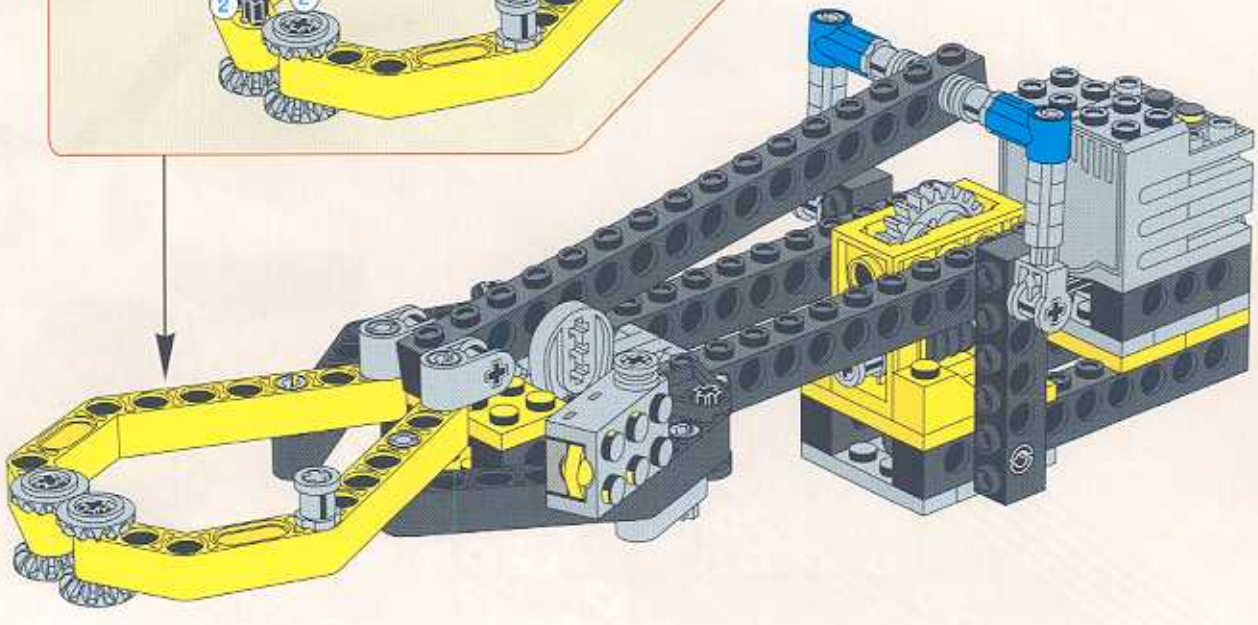
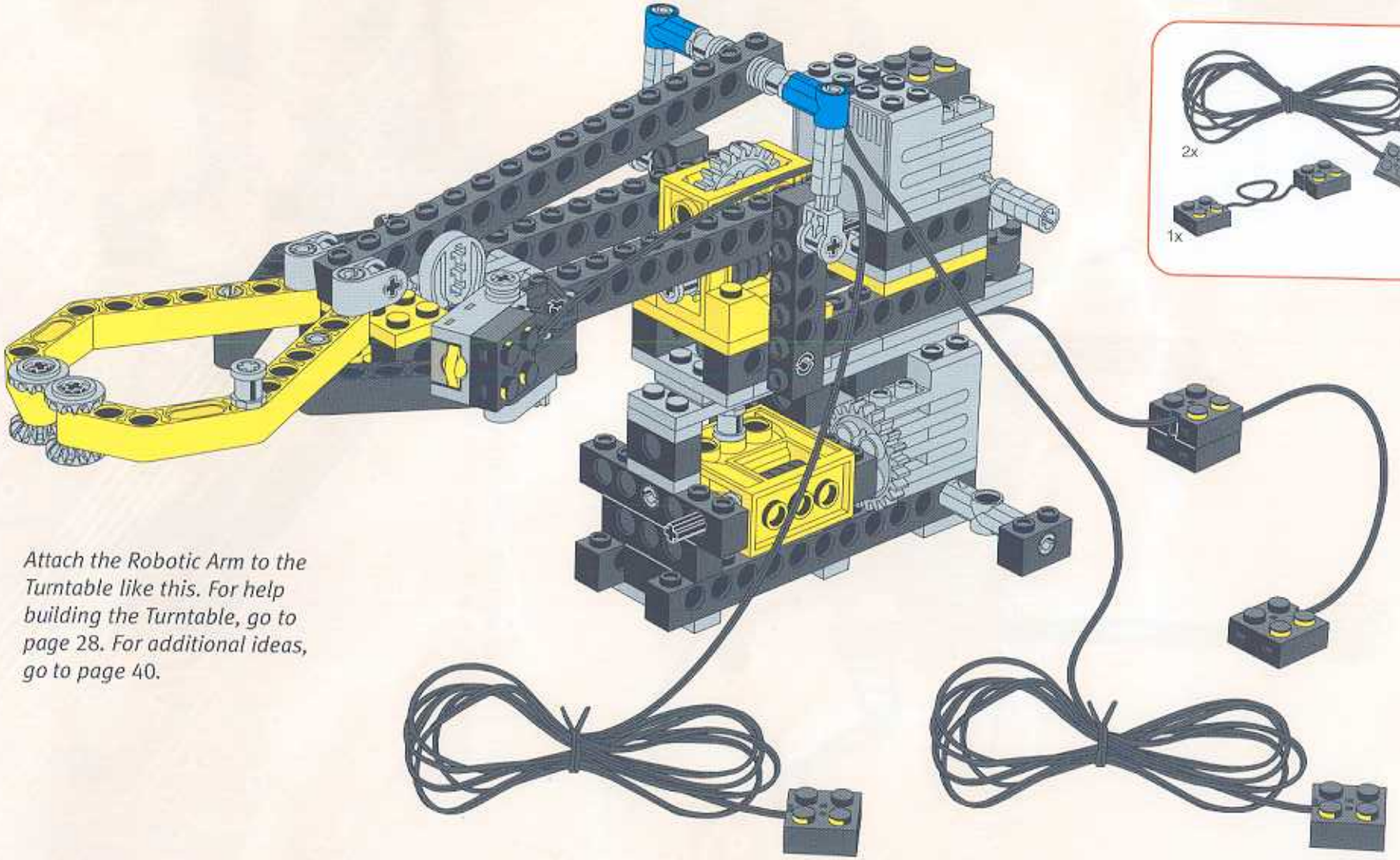










Attach the Robotic Arm to the Turntable like this. For help building the Turntable, go to page 28. For additional ideas, go to page 40.

ADDITIONAL IDEAS

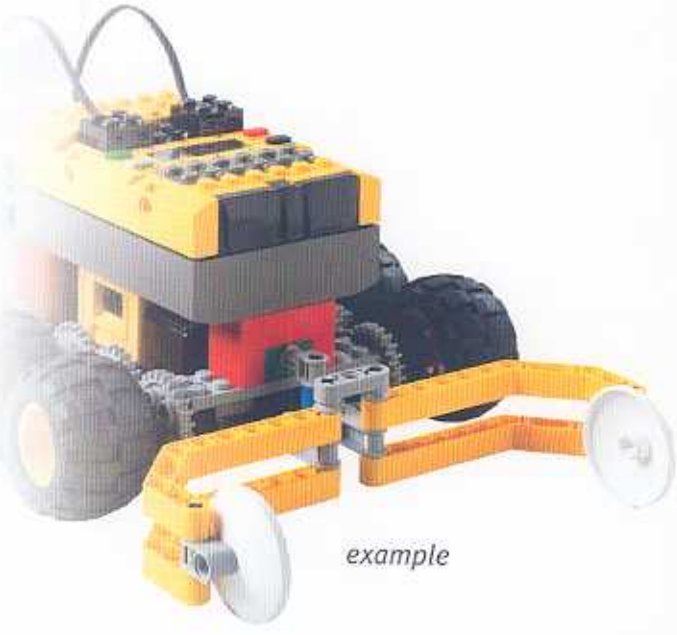
This is an example of how to control Rover 1 from the Mars Lander.

This is an example of how to attach the Robotic Arm and Turntable to the Mars Lander.

SPECIAL FEATURES

The following pages show you ideas for dressing up your inventions.

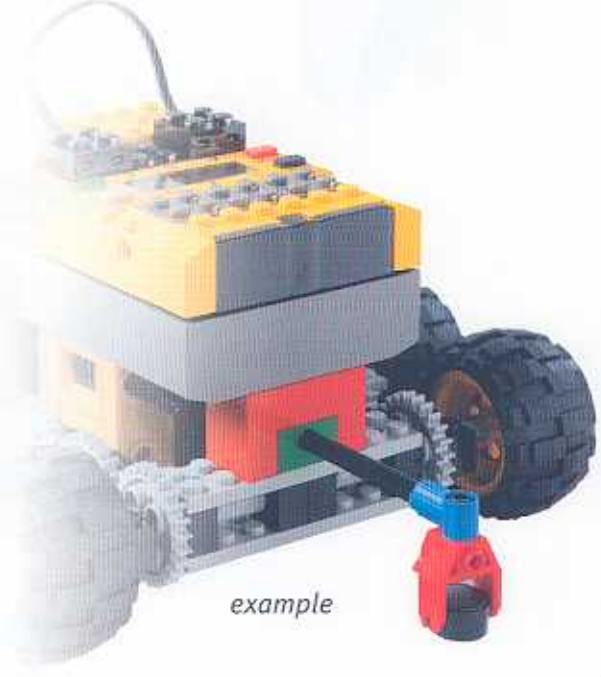
Dozer Blade
This is an example of how to build a Dozer Blade.



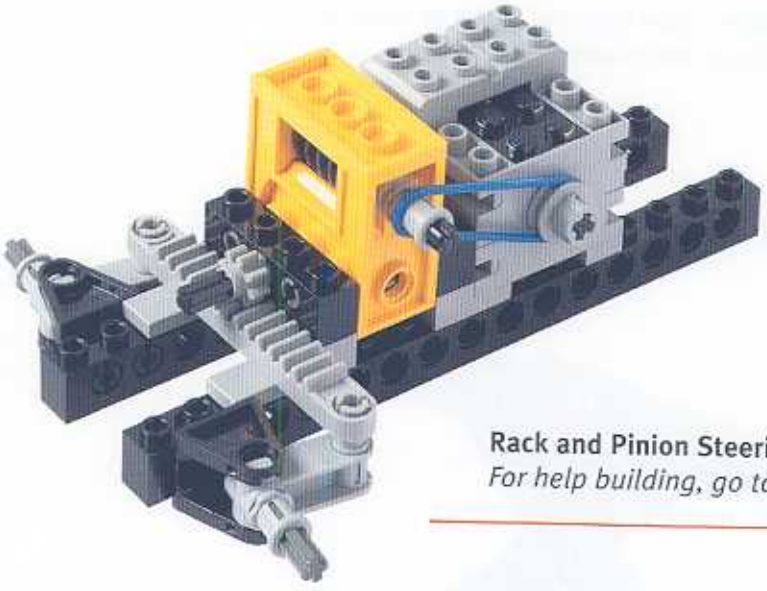
example

Off-Track Wheels

Magnetic Arm



example

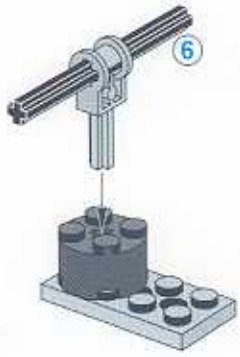


Rack and Pinion Steering
For help building, go to page 45.

Touch Sensor Steering

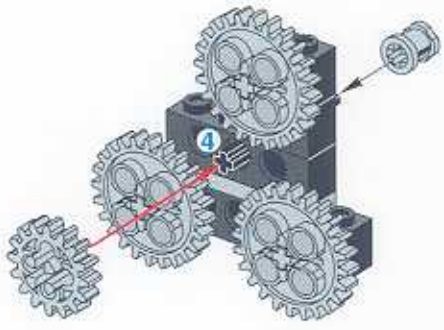
TIPS & TRICKS

These two pages show tips and tricks to make your inventions bigger and stronger.

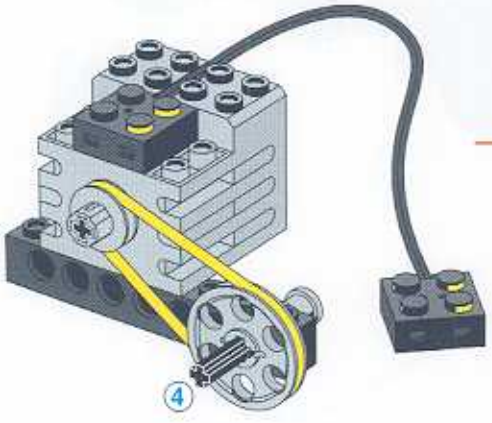


Adding an axle

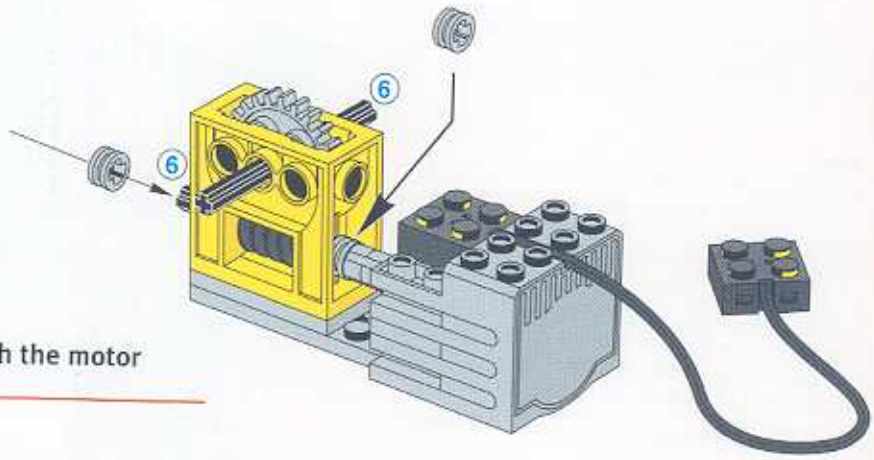
Making a lander leg



Linking gears

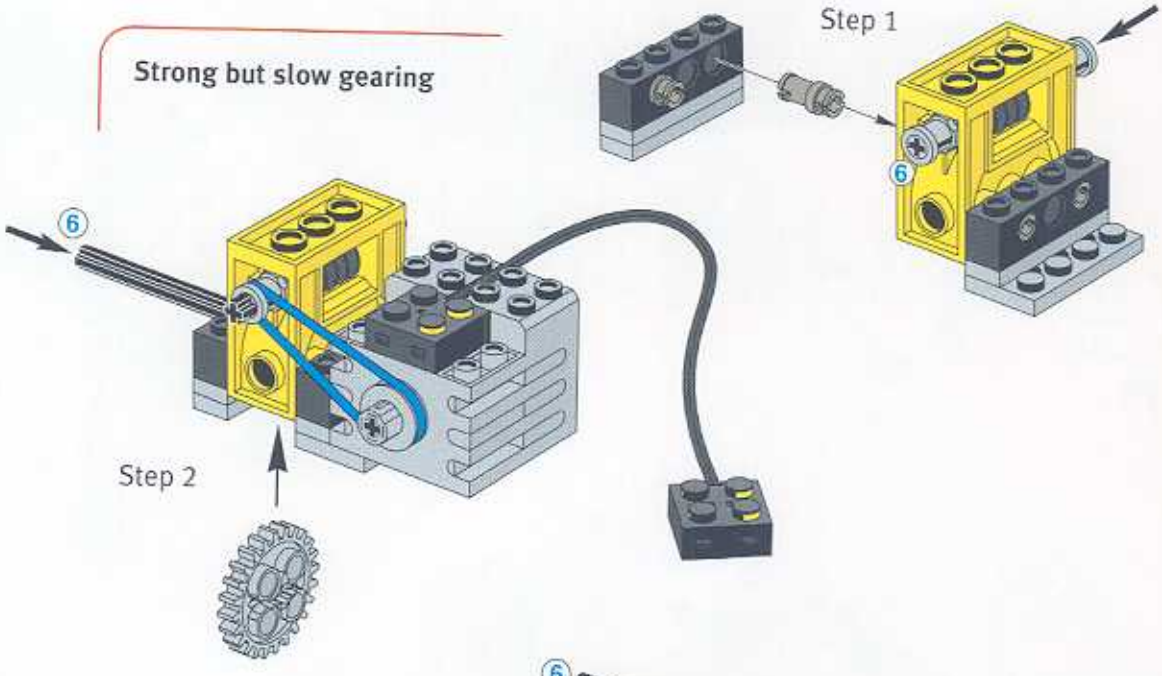


Using pulley wheels

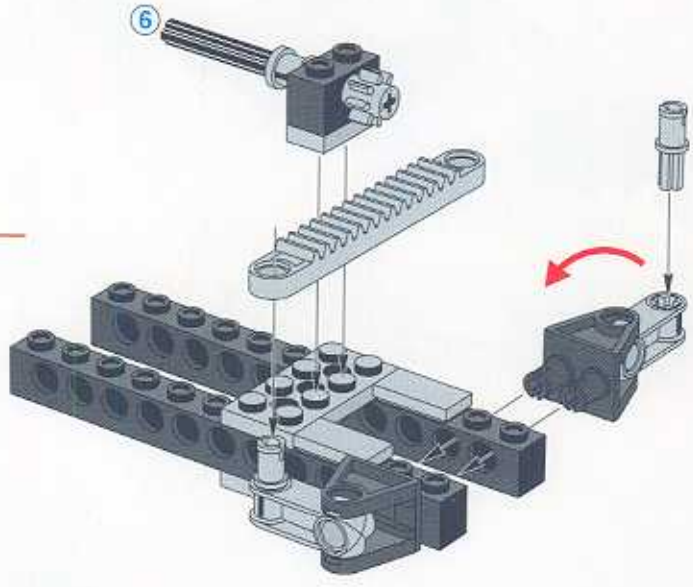


Using the gear block with the motor

Strong but slow gearing



Steering construction



TOP SECRET

CODE: NU-ML9736 DEP.: MINDSTORMS
REF: Mass Launcher on Mars
FAO: MB, SC, BHN, PM, MD, SL, ICU

MB, SC, BHN
We are at the final stage of testing for the Mass Launcher (ML) prototype on Mars. With the ML prototype, we have successfully sent materials into a LO (Low Orbit) and will aim for PIO (Phobos Insertion Orbit) when we build the real ML.

The program used to drive the ML is in RCX Code. Touch Sensors are used to control the LA1 (Loading Arm) and LA2 (Launching Arm). The LA1 loads mass onto the LA2 and the LA2 shoots the object into orbit.

The ML is designed to work in a low gravity environment.


friction on ML at Equator
be calculated...
pe velocity for Mars is set to
OPOSAL for transport of raw mate
be drafted soon.
Please consider Mindstorms unit for transport to MHO (Mars High Orbit) or PIO
obos Insertion Orbit). It will prove essential to further exploitation of Mars
ources to have a number of Mass Launchers on the Equator by the end of
ar 5 (Earth year 2005)
sted number of ML: 10 pcs. by Year 3 and 20 by Year 5.
NKN: Can we venture into search for H20 an CO2? Benefit = propulsion for ships
SAC: What about collection of electrons for propulsion, that is: Mars LO?
MG: Insertion of mirrors for terraforming – release of H2O in atmosphe
ote to above (HM): What is time frame on this??
YR: The search for H20 and CO2 has high priority with GP and GS.
MEMBER: The ML project has TOP SECRET status until 2000
News releases on mindstorms.com has been coordinated.
MARS topographical chart
2000-04-25/tegorelaysatellite1
12
22
32
11
34
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STORMS
115
MOTOR.
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WORDS.
8
... friction on ML at Equator ...
... be calculated ...
escape velocity for Mars is set to ...
PROPOSAL for transport of raw mate... be drafted soon.
Please consider Mindstorms unit for transport to MHO (Mars High Orbit) or PIO (Phobos Insertion Orbit). It will prove essential to further exploitation of Mars ssources to have a number of Mass Launchers on the Equator by the end of year 5 (Earth year 2005).
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Note to above (HM): What is time frame on this??
YR: The search for H20 and CO2 has high priority with GP and GS
REMEMBER: The ML project has TOP SECRET status until 2000
News releases on mindstorms.com has been coordinated.
MASS LAUNCHER
4
6
MARS topographical chart
2000-04-23/legorelaysatellite1
12
22
32
11
34
56
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TERRAFORM MARS

CAMERA REFERENCE

This page is for those of you who have a PC video camera connected to your computer.

These two models are examples of how to connect a camera to your robotic inventions. They can be used with the Ranger and Surveyor Missions on the the CD-ROM.

The Exploration Mars software works with most PC video cameras. If you already have a PC video camera, please refer to those instructions for help on connecting it to your computer.
If you have any problems with your camera, please contact the manufacturer.


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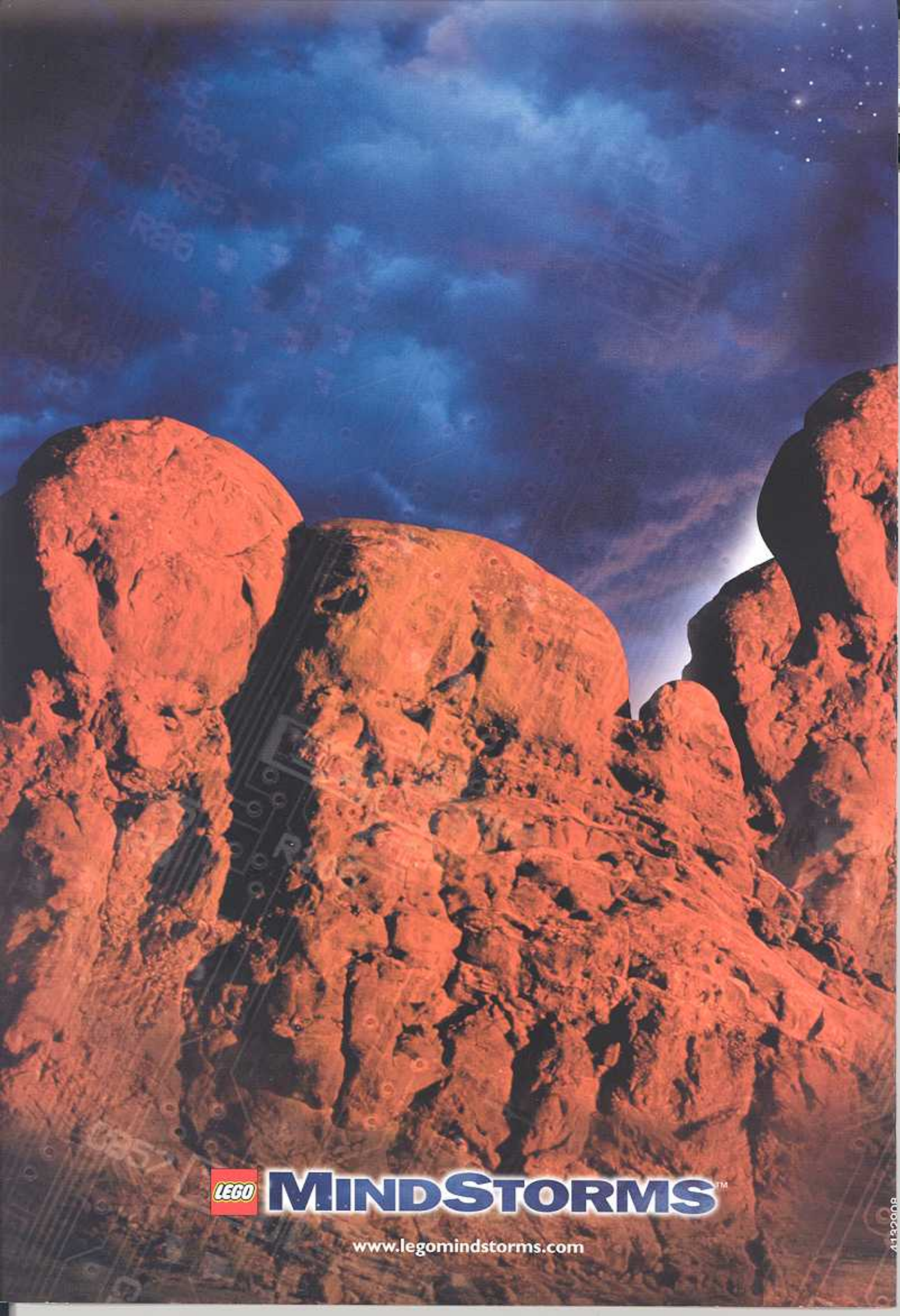
LEGO MINDSTORMS™
www.legomindstorms.com