The Kepler Transit Demonstration

The Kepler Transit Demonstration illustrates how the Kepler science team will discover Earth-size planets around other stars by the transit method with the Kepler satellite photometer.

This document can be downloaded from the Kepler Education website at http://kepler.nasa.gov/ed

Components:

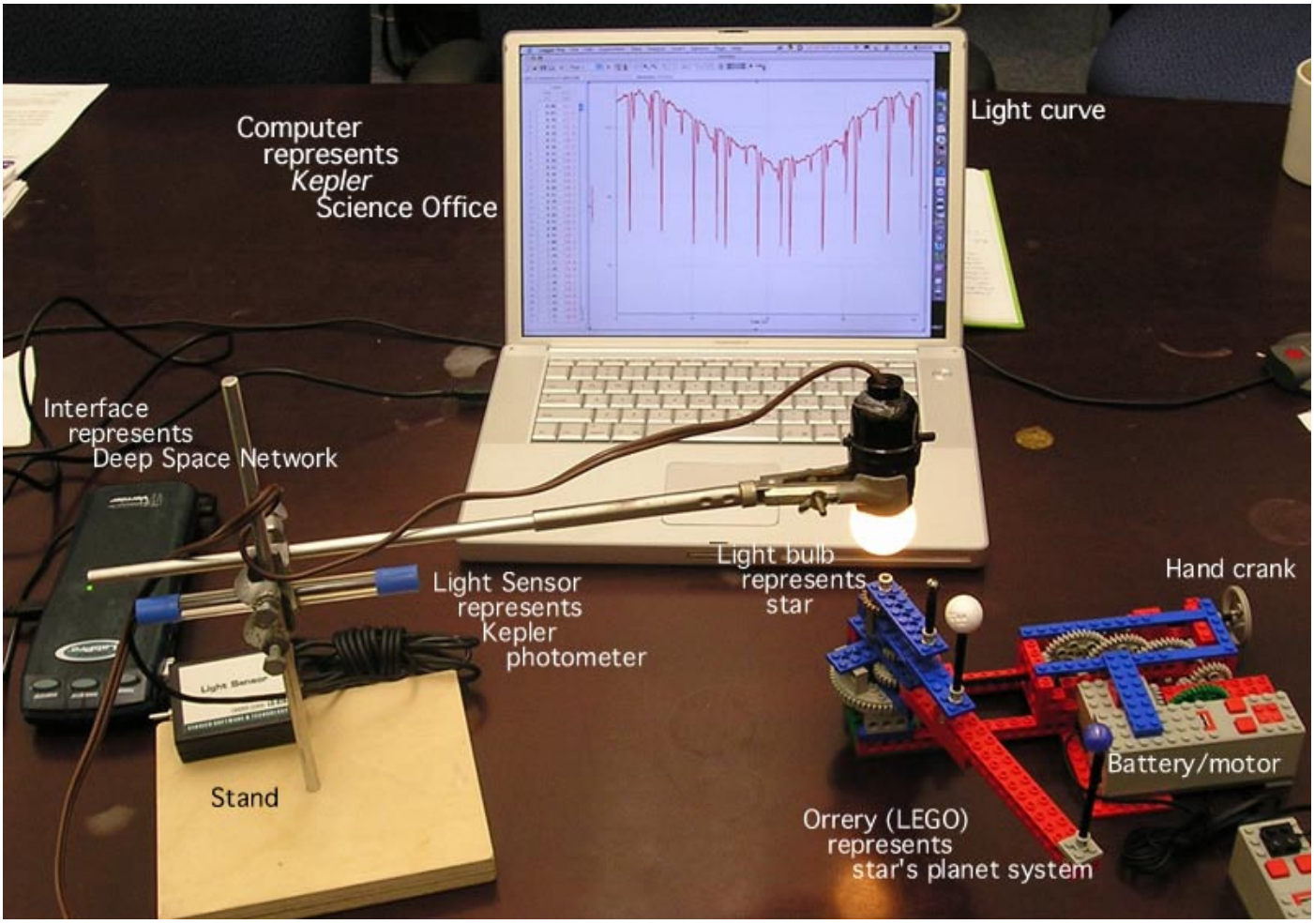
A LEGO-orrery model represents a planet system that can be set in motion with either a hand crank or electric motor.

A light bulb at the center of the orrery represents the star.

A light sensor represents the Kepler spacecraft photometer.

The light sensor is connected through an interface box (which represents NASA Deep Space Network) to…

A computer that represents the Kepler Science Office.



Produced for NASA's Kepler Mission

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Sources of components:

From LEGO supply—these kits:

W979649 LEGO Technology Resource Set ($57 July, 2005)
W779876 LEGO Large Turntable (set of 2; $10, July, 2005)
W979615 LEGO 9V motoer and battery (optional; $33, July, 2005)
see http://www.legoeducationstore.com

Computer-interfaced light sensor
(e.g. from *Vernier Software and Technology*
http://www.vernier.com/)

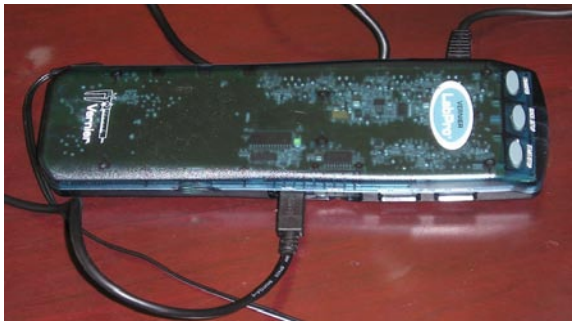
Interface: Go! Link $59.00 (Sep 2004)
Light Sensor LS-BTA $45.00 (Sep 2004)
Software: Logger *Pro* 3 [LP] $149 (Sep 2004) for PC and Mac [you can also download free demo version]

From a science company (e.g. Science Kit
http://www.sciencekit.com/)

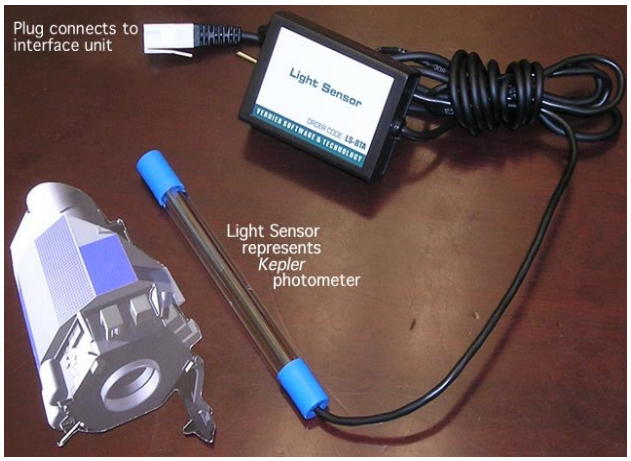
Metal Base (10cm x 15cm) with Rod Size (8mm dia x 46mm long) $8.95 WW6308001
Buret Clamp Plain jaws $7.60 WW6107500 Plastic jaws $8.75 WW6108000, adjustable, to hold light sensor
Right Angle Clamp Holder - (6112000) $7.95 (to hold horizontal rod for clamp on utility light)
Clamp On Utility Light $11.90 WW4639500

Reflector is not needed.

Buret Clamp s



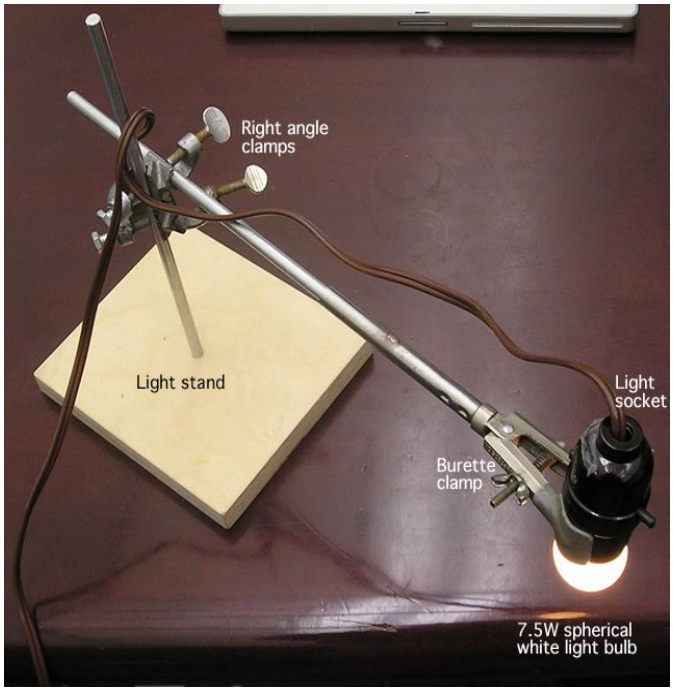
Vernier interface shown here is for 4 inputs. The Go! Link unit is all that is needed for 1 input.

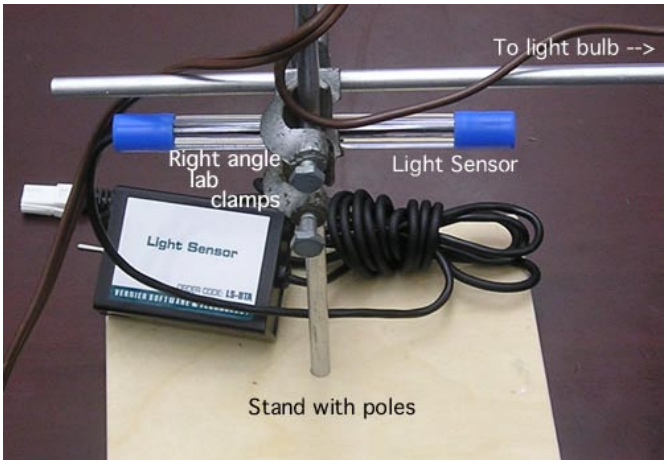


From a hardware store

Light bulb, 7.5W, medium standard base, about 1.3” dia.
An extra metal rod as a horizontal support for clamp on utility light

The stand to hold the light and light sensor and also be assembled from PVC tubing and fittings.





4-planet LEGO orrery assembly instructions

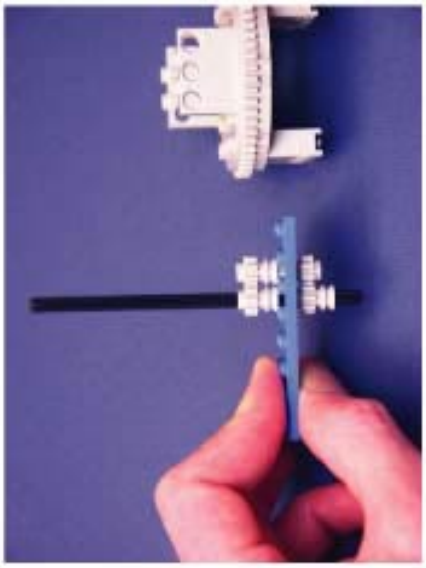
Non-motorized

The following kits together contain enough parts to make two non-motorized orreries:

W979649 LEGO Technology Resource Set
W779876 LEGO Large Turntable (set of 2)

Motorized

Add one W979615 (LEGO 9V motor and battery box) kit per orrery to make the motorized version.



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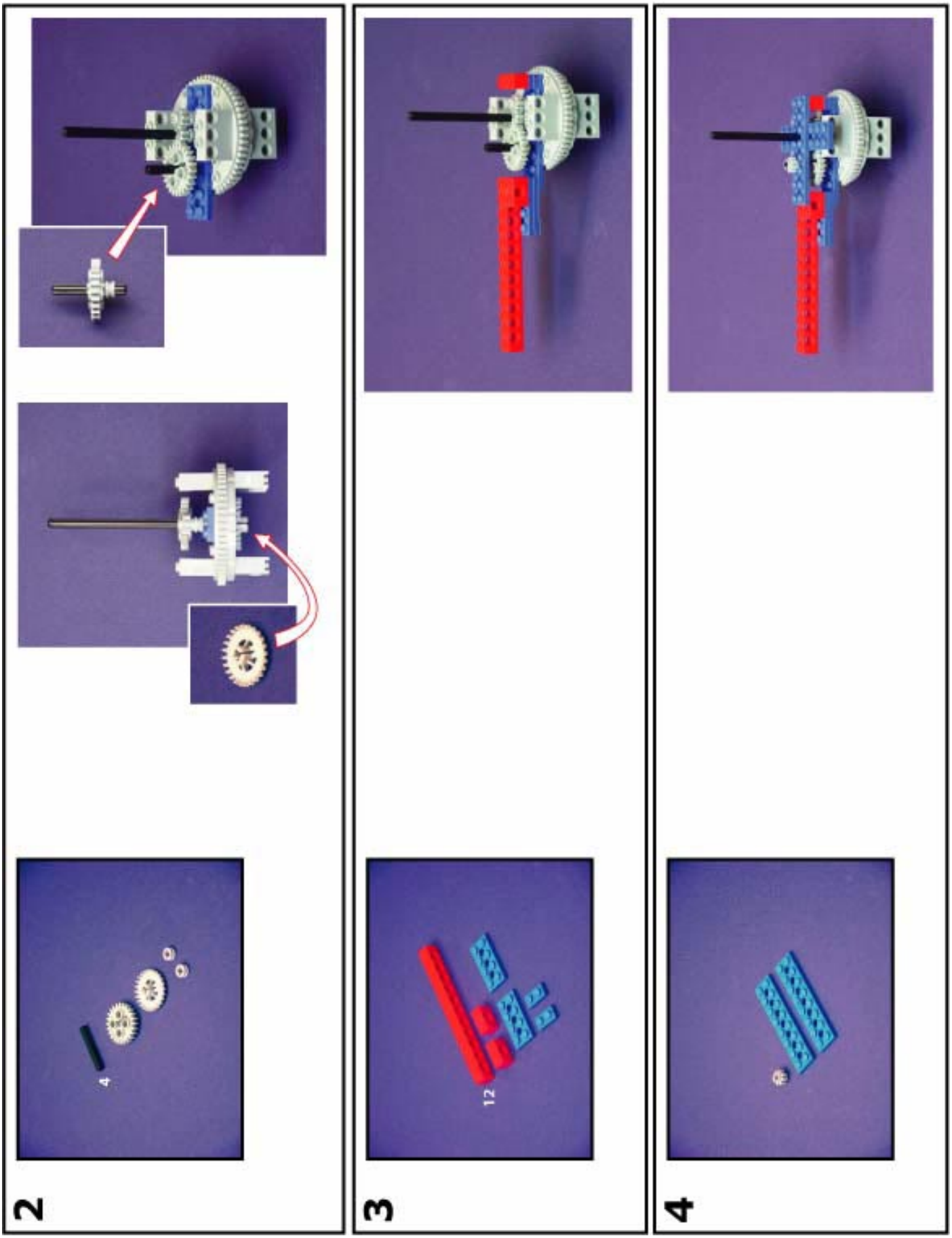
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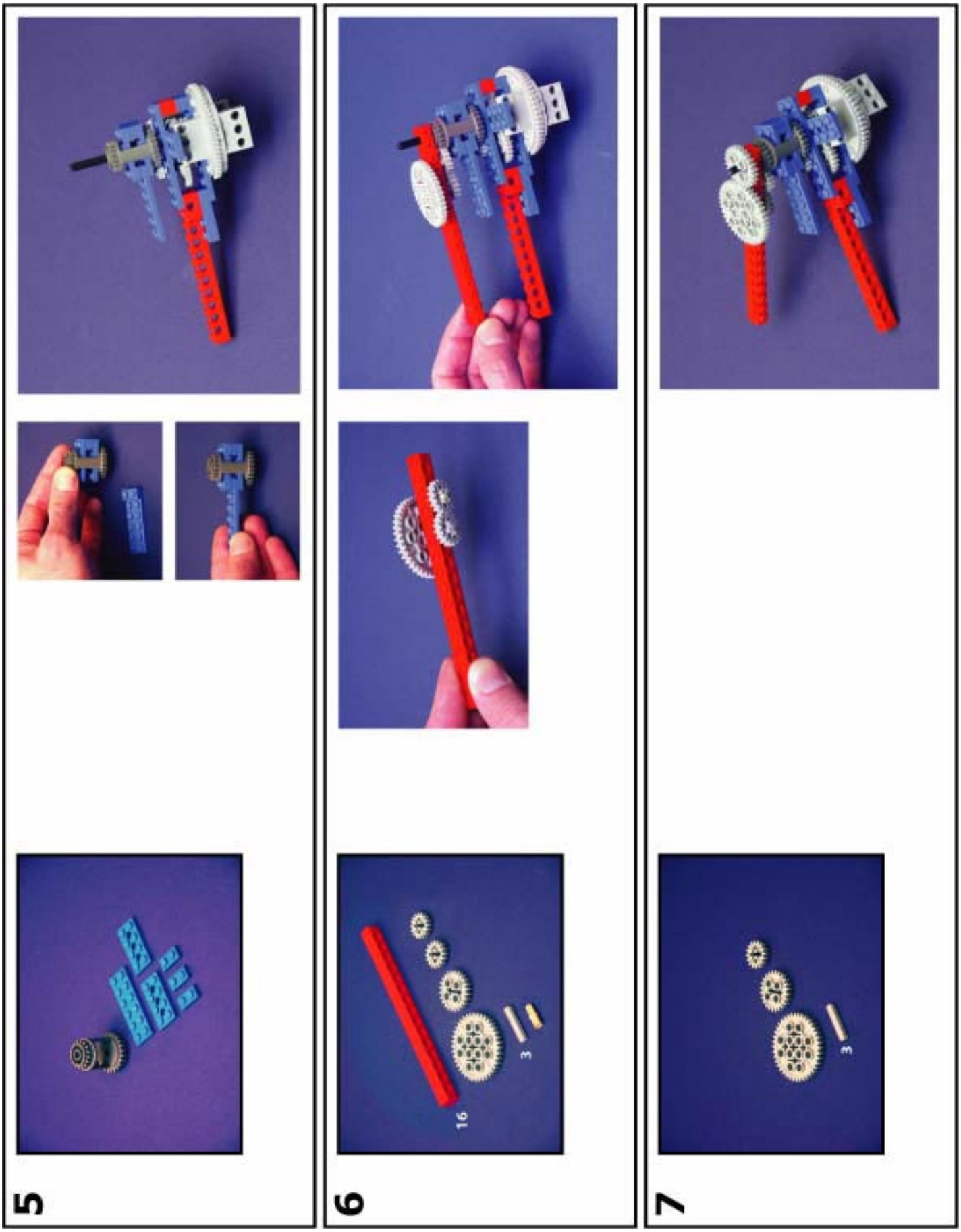
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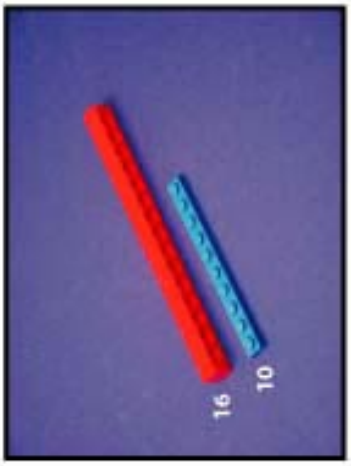

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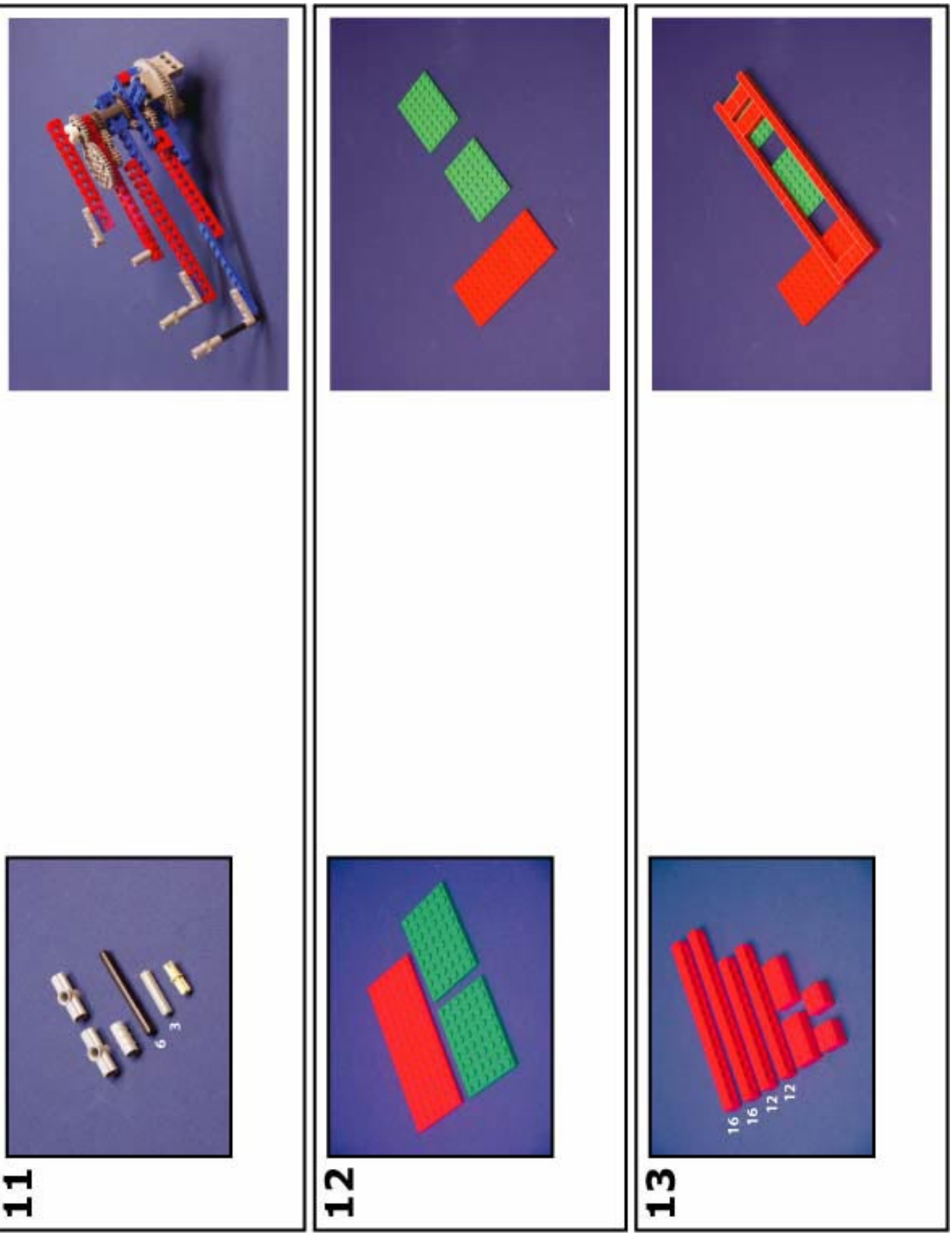
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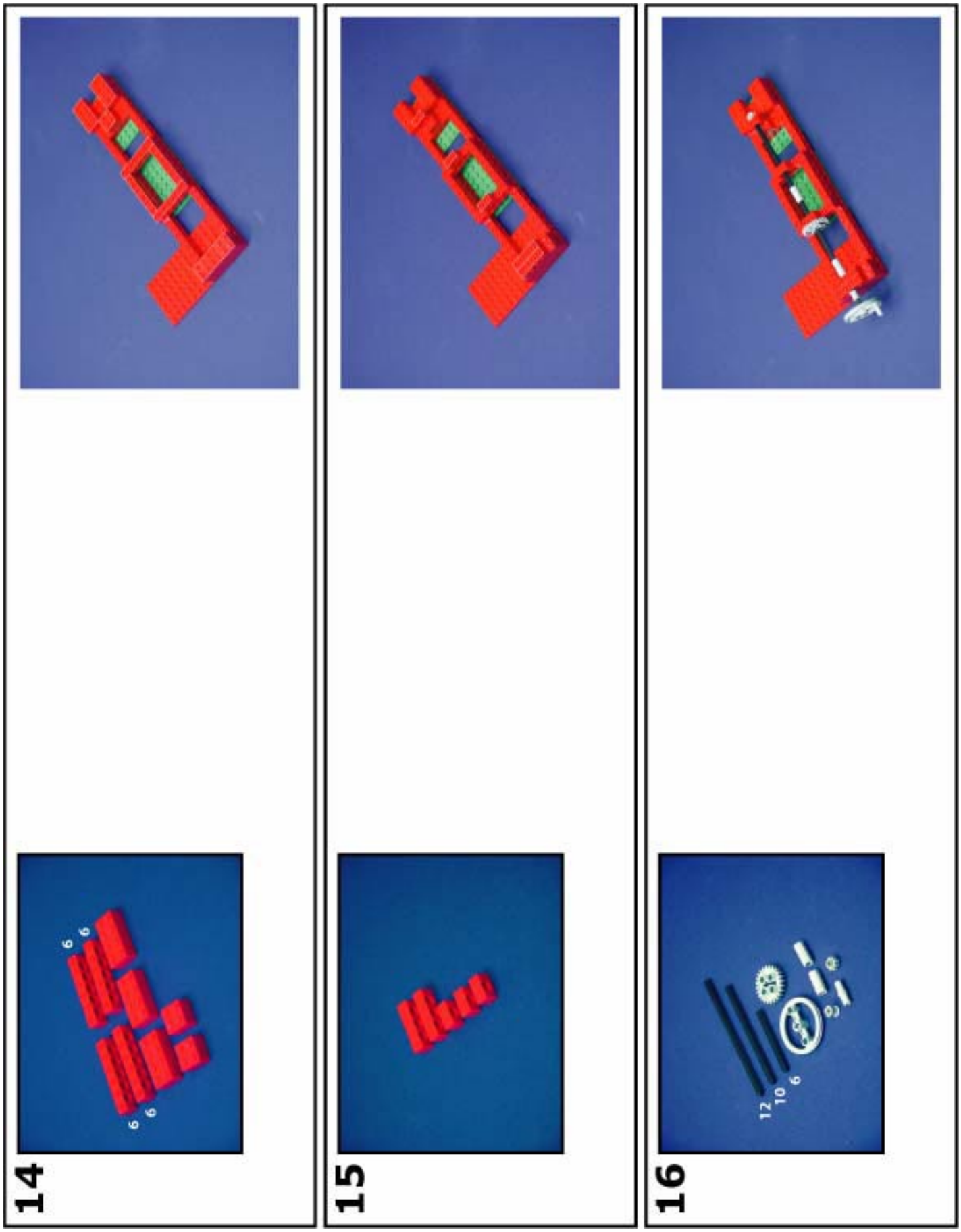
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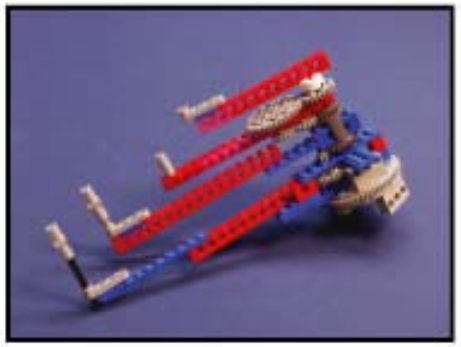

From step 11

18

To make interchangeable planet rods:

a. Notch LEGO rods.

b. Glue beads to pins or nails.

c. Tie pins/nails to LEGO rods using fishing line (make sure the distance from the "equator" of each bead to the end of the LEGO rod is the same for all four beads).

d. Seal knots in fishing line with super glue (Note: Super glue does not stick to polyethylene LEGO rods; the glue adheres only to the pin and the fishing line.)

a.

c.

d.

Orrery is now ready for manual operation:

To make the model accurate in terms of Kepler's laws of planetary motion, adjust the lengths of the arms according to the formula below:

$$\frac{(\text{Orbit Period})^2}{(\text{Orbit Radius})^3} = \text{Constant}$$

For motorized operation, build motor assembly as shown in steps 19–28

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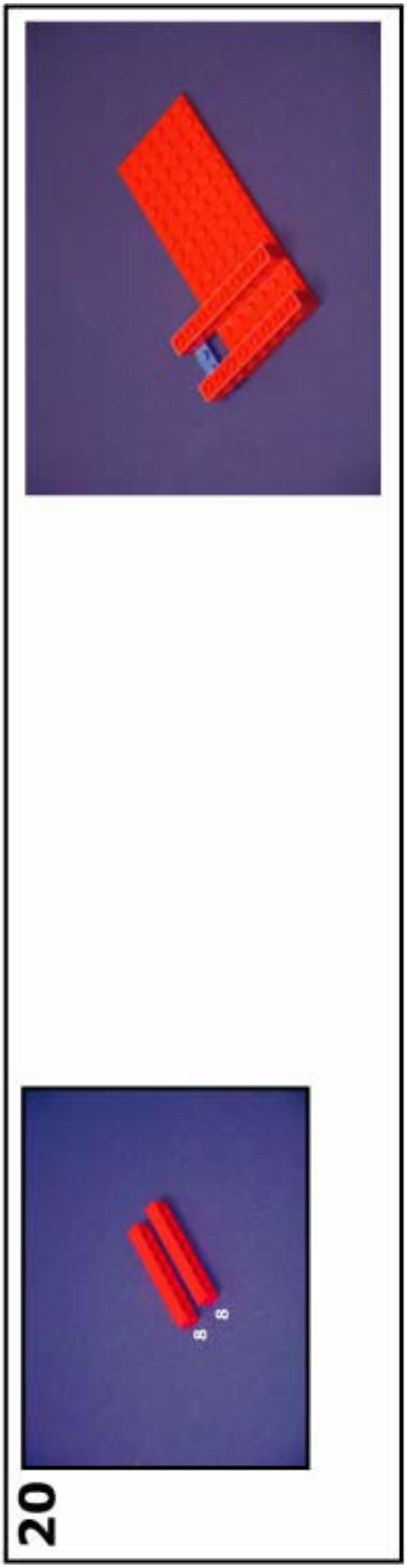
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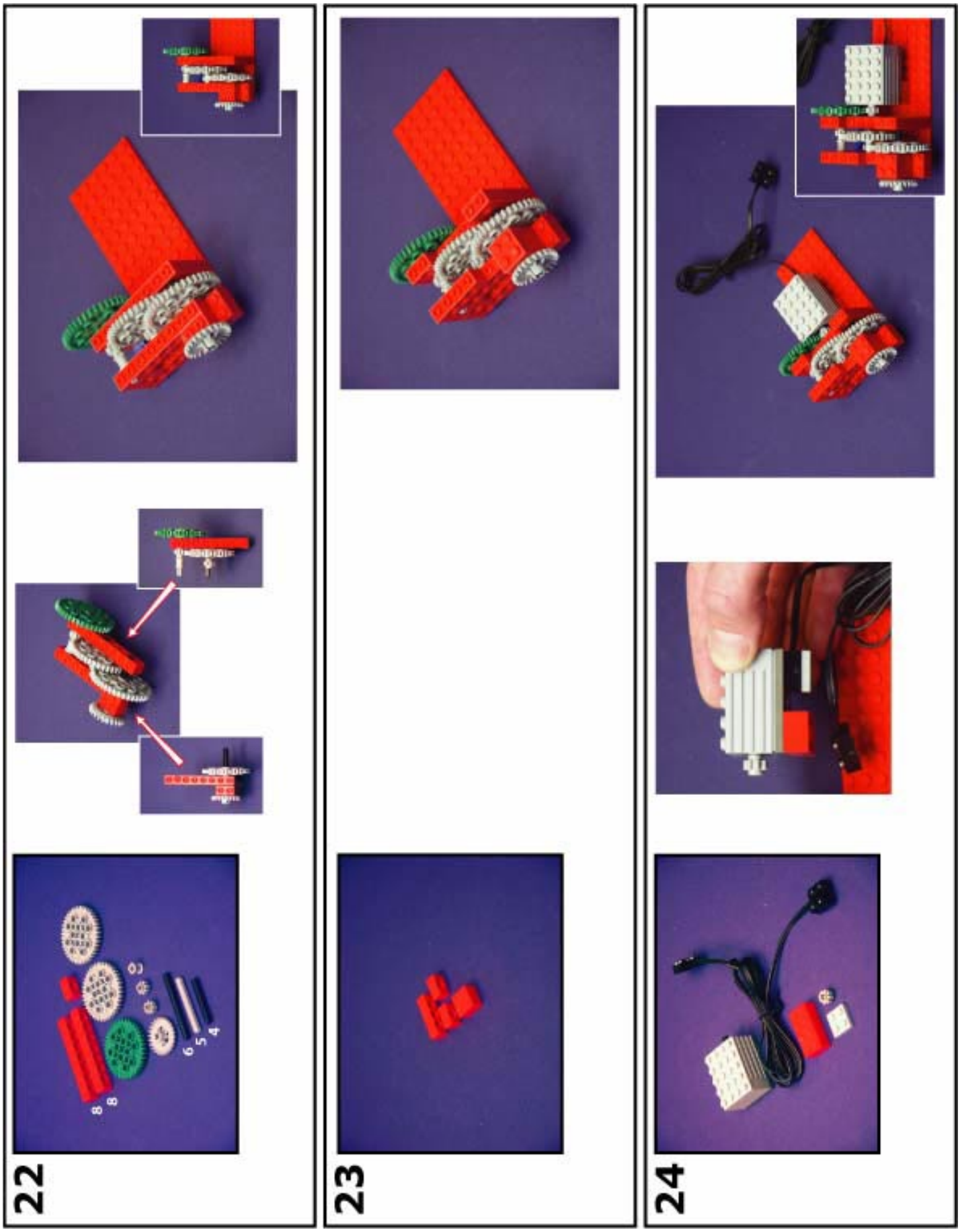
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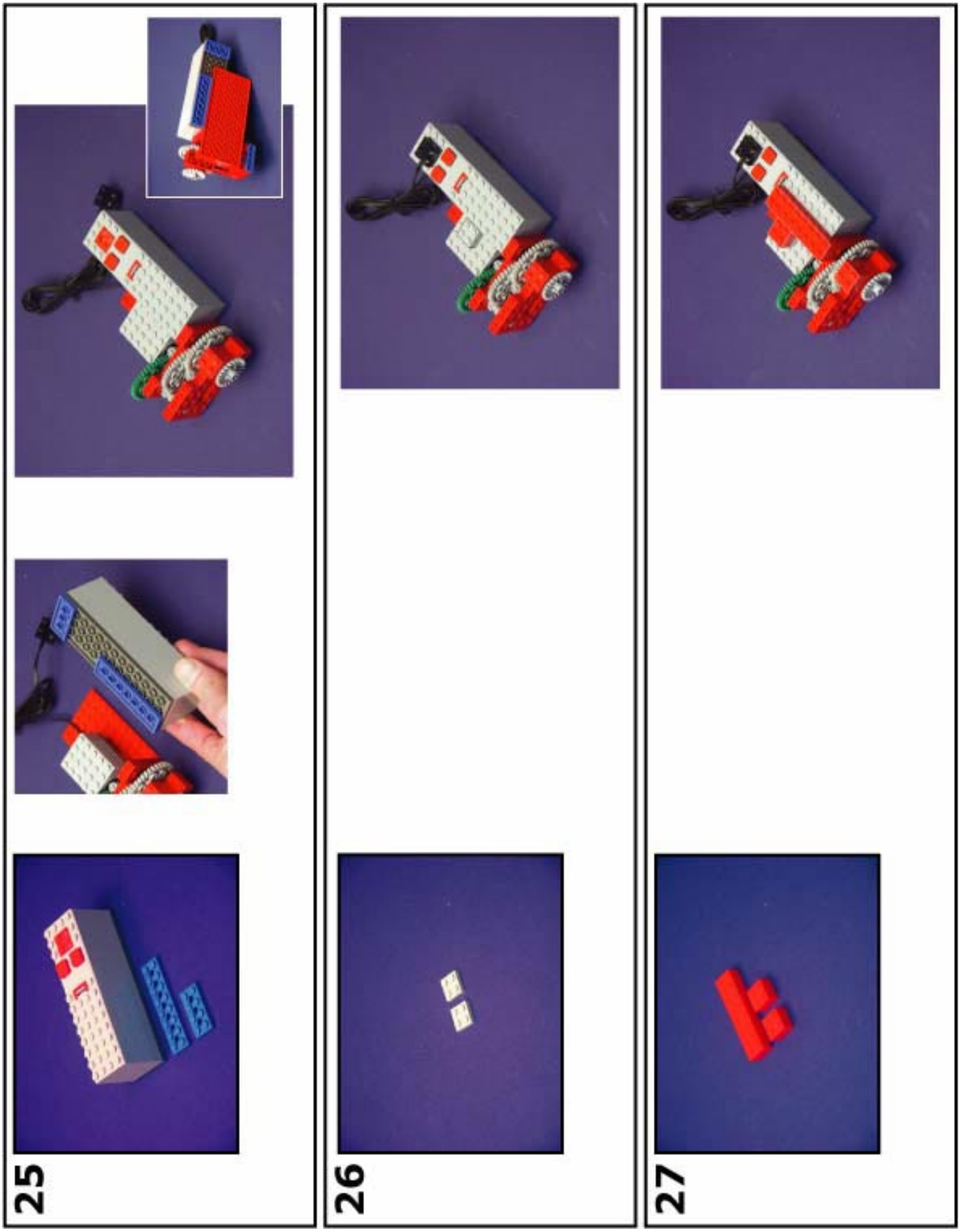
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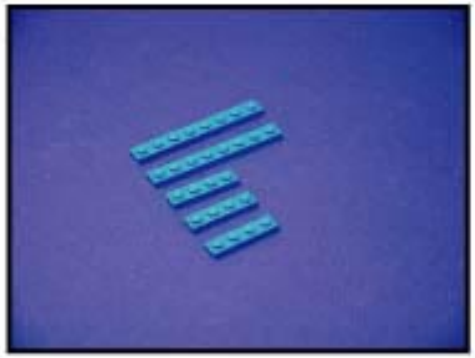
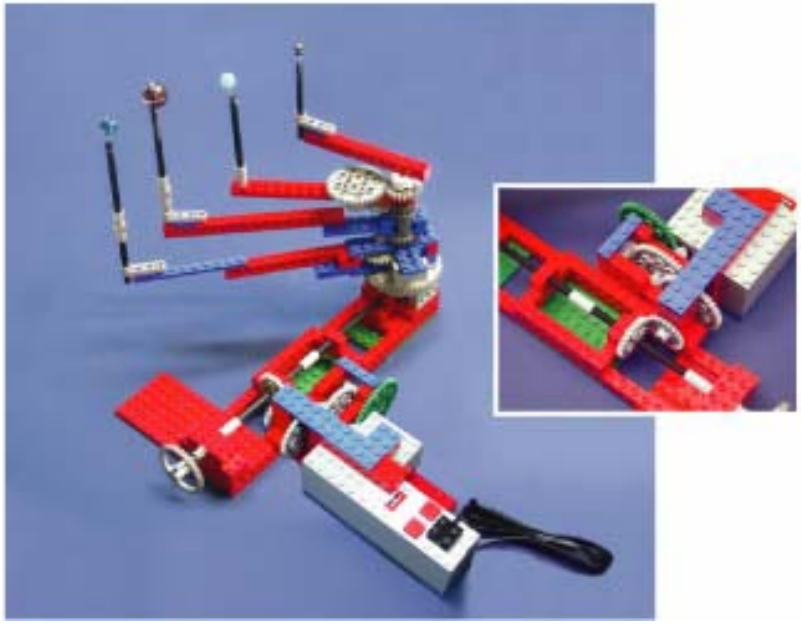
Attach motor assembly as shown for motorized operation: