

Instructions for Assembling Pendulum Clock Of Thames and Kosmos Physics Workshop #33, page 57

This is most difficult and the most rewarding project in the kit. Take your time and have fun “adjusting” it after you get it together. Perhaps you could find improvements. These instructions are not “step-by-step” but contain the detailed information to allow you to construct this project easily.

Part list

1 baseplate
2 grey long frames
4 long grey rods (three are for the pendulum)
4 large yellow gear wheels
1 medium yellow gear wheel
5 small yellow gear wheels
3 large green sprocket wheels
3 medium green sprocket wheels
1 small green sprocket wheel
6 washers
4 axle locks
2 red anchor pins
1 red joint pin
2 red shaft plugs
2 red crankshafts
4 long black axles
2 medium black axles
3 short black axles
Chain of chain links
Paper clip for use as a hook
Water bottle to use as weight

1. Insert one long grey frame into the baseplate on the fourth row of holes from the end. The second long frame will be placed later at the farther edge of the baseplate, 8 rows away. These two frames will hold all the axles and gears. Figure 1 – Left Side General View shows the positions of the two frames on the baseplate.

2. There are 5 axles inserted horizontally connecting the two frames. Two of the axles are really made by joining two axles together (see instructions). We will call these 5 axles A, B, C, D, and E. There is also a single shaft plug only placed in the front frame, not the rear, in the position indicated (see Figure 3 – Front View Axles) which is one hole lower than axle B. This shaft plug holds one medium yellow gear wheel in front of the front frame. This gear meshes with the large yellow gear wheel above it (also outside the front frame) on axle D.

3. Looking at the “front” of the clock, the axles A through E are placed as indicated (see Figure 3 – Front View Axles and Figure 4 – Rear View Axles) in the frames. Count the

empty holes in the frame to make sure the axles are inserted into the right holes. All axles are parallel and level.

NOTE: Each axle has a “stop” enlargement about one-half inch from ONE of its ends. This will keep the axle from going completely through a frame hole. We will call this the “stop end” of the axle. When assembling you must note where the axle stop enlargement is and place the gears on the axle before or after the axle is inserted through a frame hole as appropriate.

Now here are the parts listed IN ORDER placed on each axle from front to back and with the axle stop end indicated:

Axle A: front frame, large green sprocket wheel (about ½ inch behind frame, this wheel will take the chain holding the water bottle weight and does not mesh with any other wheel), large yellow gear wheel (which meshes with small yellow gear on axle B), rear frame, axle stop (outside rear frame).

Axle B: front frame, large yellow gear wheel (about a ¼ inch from front frame and this gear meshes with the small yellow gear wheel above it on axle D), small yellow gear wheel, washer, rear frame, axle stop outside rear frame. (Note that the small yellow gear wheel and washer are right against the rear frame and this small gear meshes with the large yellow gear to its left on axle A.)

Axle C: This axle is composed of TWO medium axles and is the most difficult axle to assemble. Small yellow gear wheel outside the front frame (meshes with large gear wheel to its right on axle D), washer, the frame, axle stop enlargement, small yellow gear wheel, large green sprocket wheel which also joins the two medium axles, yellow gear wheel (the two yellow gears on either side of the large green sprocket wheel do not mesh with anything and serve to help hold the green sprocket wheel in place), black axle lock, another axle lock, washer, rear frame, washer, black axle lock, axle stop enlargement. NOTE that the teeth on the large green sprocket wheel on this axle accepts the two red crankshaft pins above it as they rock back and forth with the pendulum action moving axle E).

Axle D: large yellow gear wheel (meshes with medium yellow gear wheel attached to the front frame at hole “sp” with red shaft plug), axle stop enlargement (washer not needed here) front frame, washer, black axle lock, small yellow gear wheel (placed against axle lock and washer against front frame, this gear meshes with large yellow gear below it on axle B), rear frame.

Axle E: this axle is composed of one LONG axle and one SHORT axle joined by a small green sprocket wheel next to the rear frame. This is also the axle that supports the pendulum (pendulum assembled separately and attached last). Here is the order for this axle: medium green sprocket wheel at end of axle and which will accept small axle shaft of pendulum later, axle stop enlargement, front frame (there is about an inch of space between this sprocket wheel and the front frame to allow room for pendulum to swing

below), second medium green sprocket wheel (about $\frac{1}{4}$ inch behind front frame and contains a red crankshaft pin), third medium green sprocket wheel (with another crankshaft pin), small green sprocket wheel which connects the two axles, start of small axle, washer, rear frame, axle stop enlargement. NOTE: this axle is the escape movement that allows the large green sprocket wheel on axle E to move only one tooth at each swing of the pendulum. The trick here is to assemble the two medium green sprocket wheels (each containing a red crankshaft pin in its outer hole) so that each pin touches the other sprocket wheel opposite. The pins only firmly touch the other sprocket wheel on the side and should be spaced so as to allow only one sprocket tooth to pass beneath with each swing of the pendulum (about a 90-degree separation angle with the axle). This is the "heart" of the clock and may need some adjusting.

Use one long rod with anchor pins to join the tops of the two long frames together.

Assemble pendulum and attach to axle E (hanging over table edge) so that it can swing freely.

Attach chain with water bottle weight to large green sprocket wheel on axle A.

You may have to move the pendulum by hand to get it to swing high enough to get the clock to work. Experiment with different weights and pendulum lengths. This is REALLY COOL!

PICTURES REFERRED TO IN THE INSTRUCTIONS

Figure 1 - Left Side general view

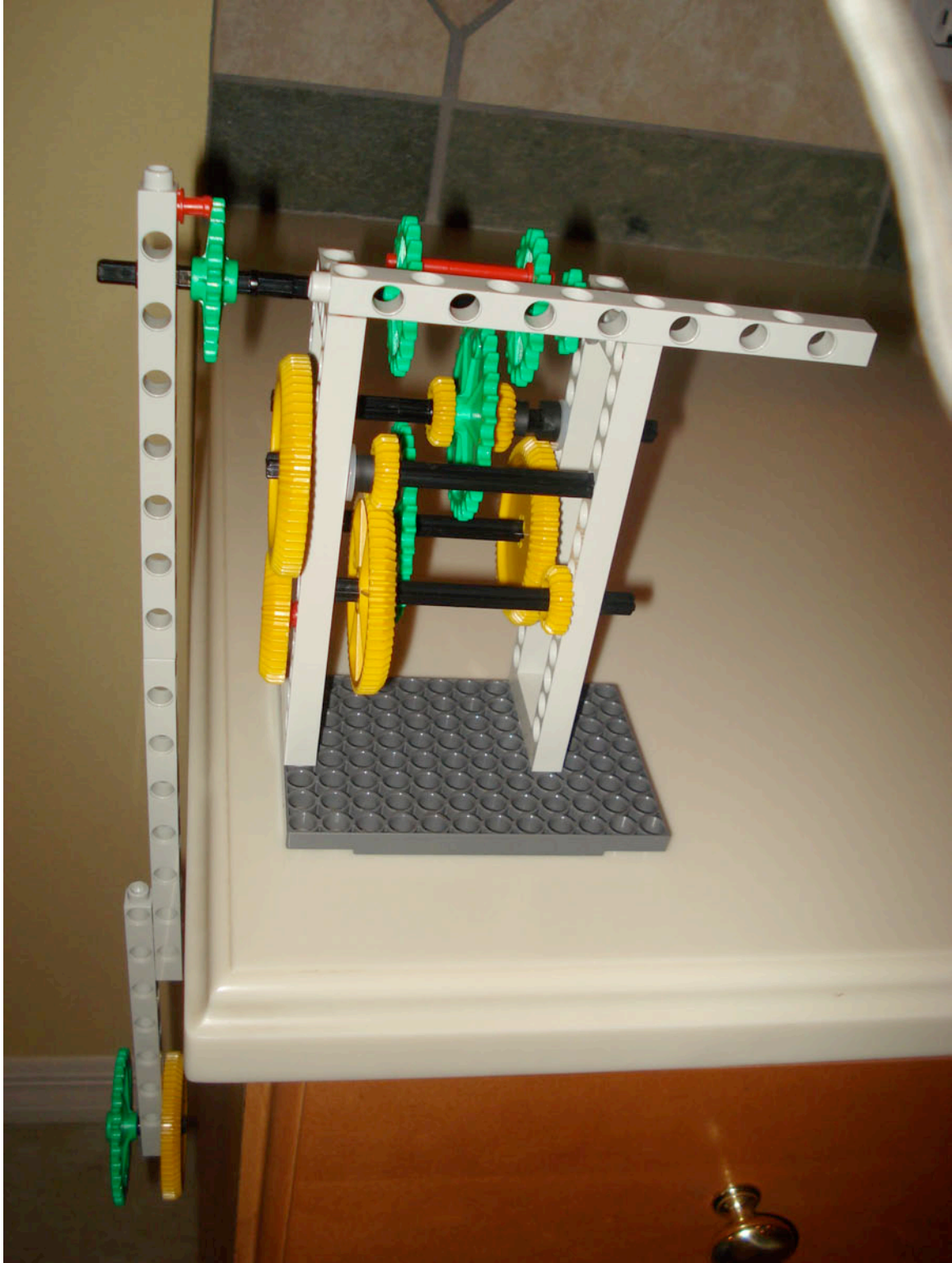


Figure 2 - Left Side Axles

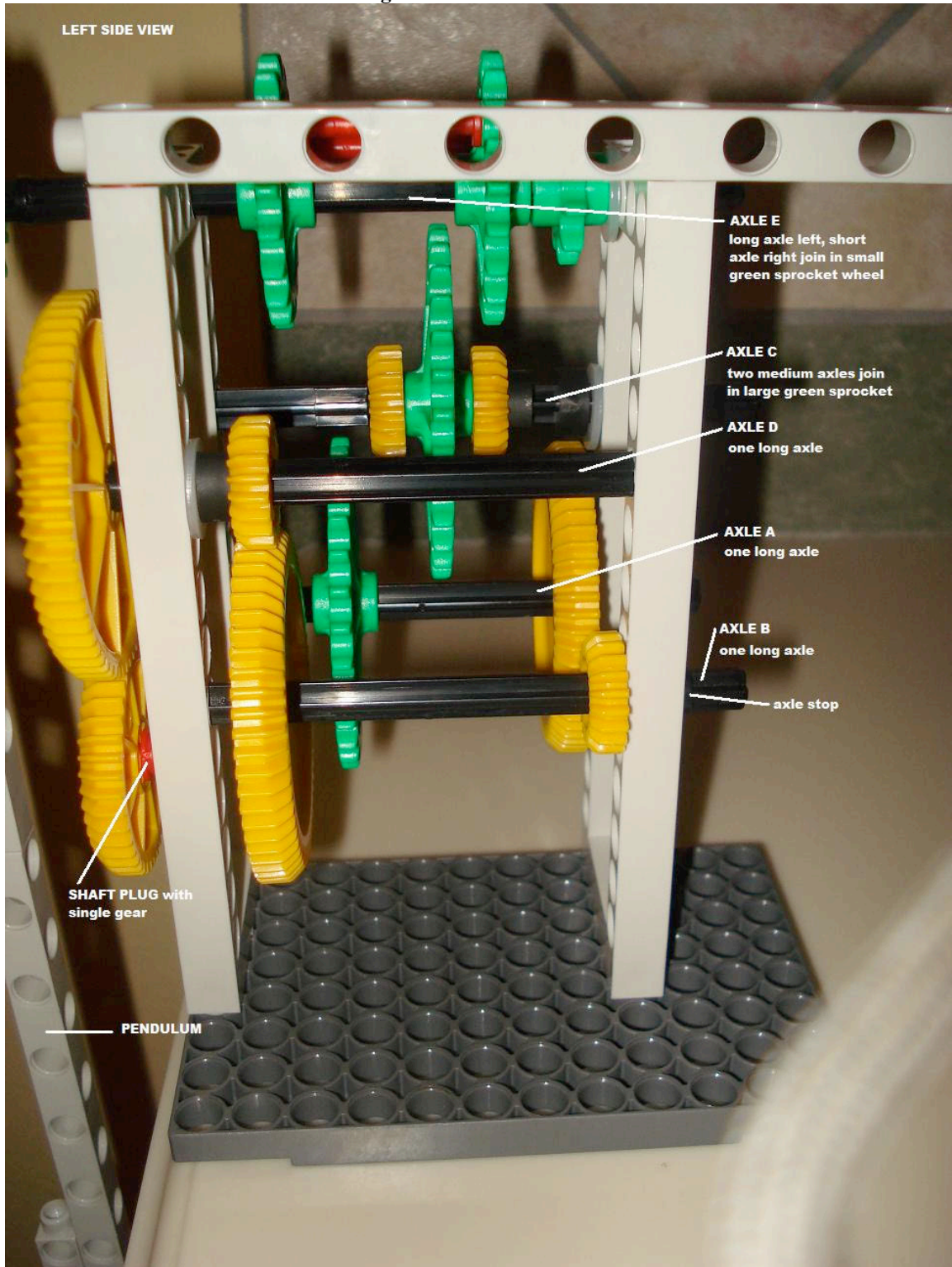


Figure 3 - Front View Axles

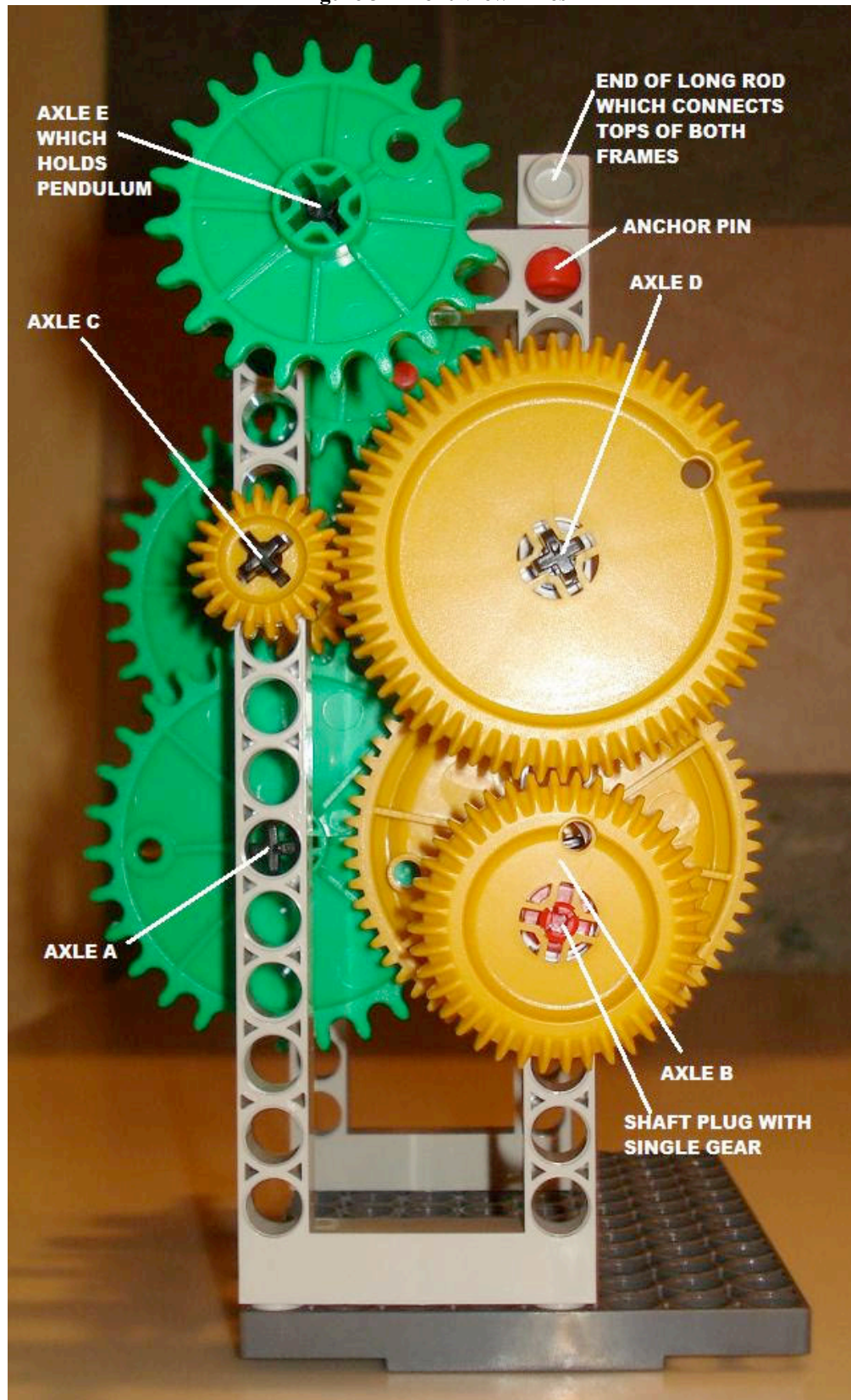


Figure 4 - Rear View Axles

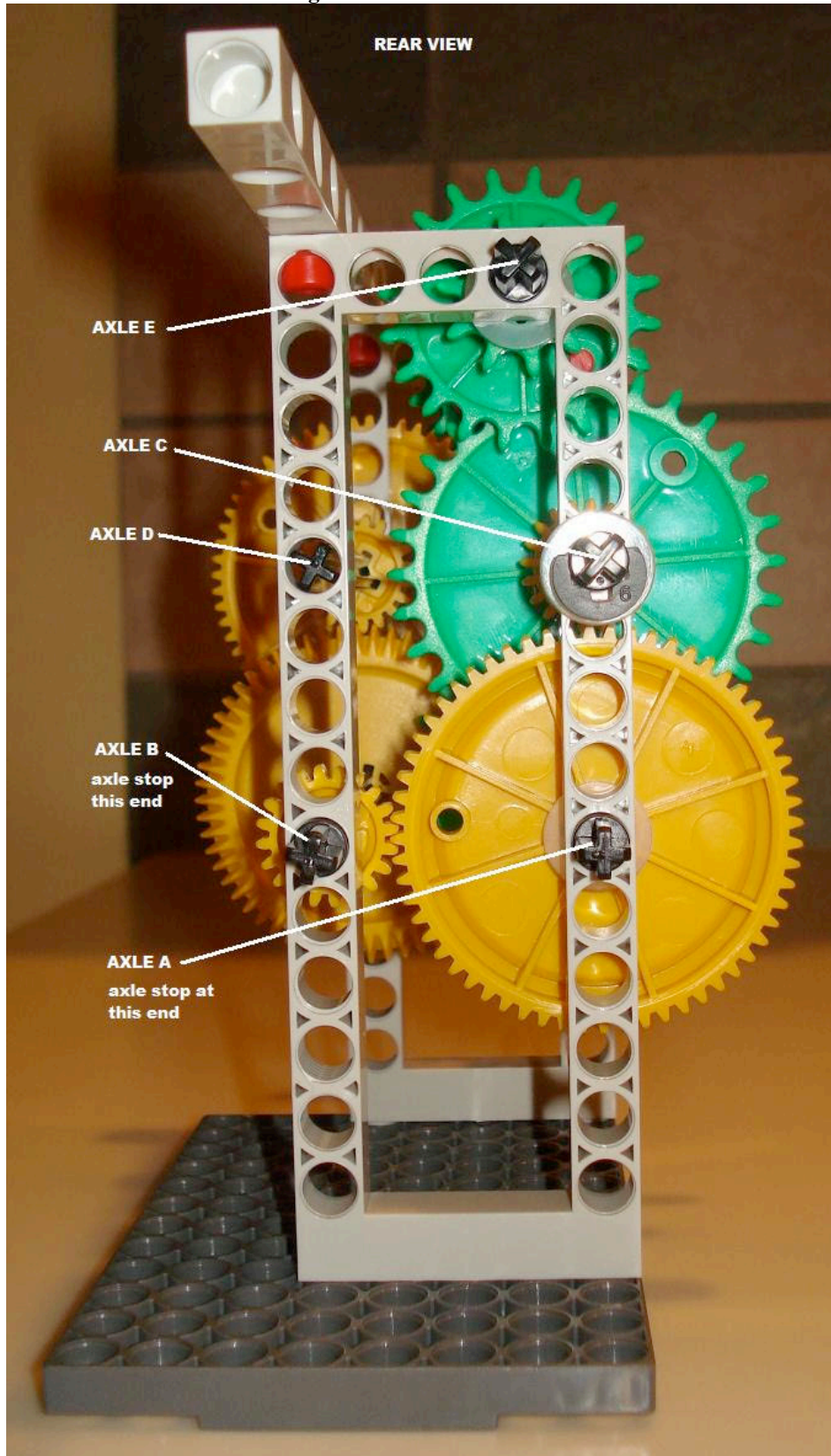


Figure 5 - Right Side Axles

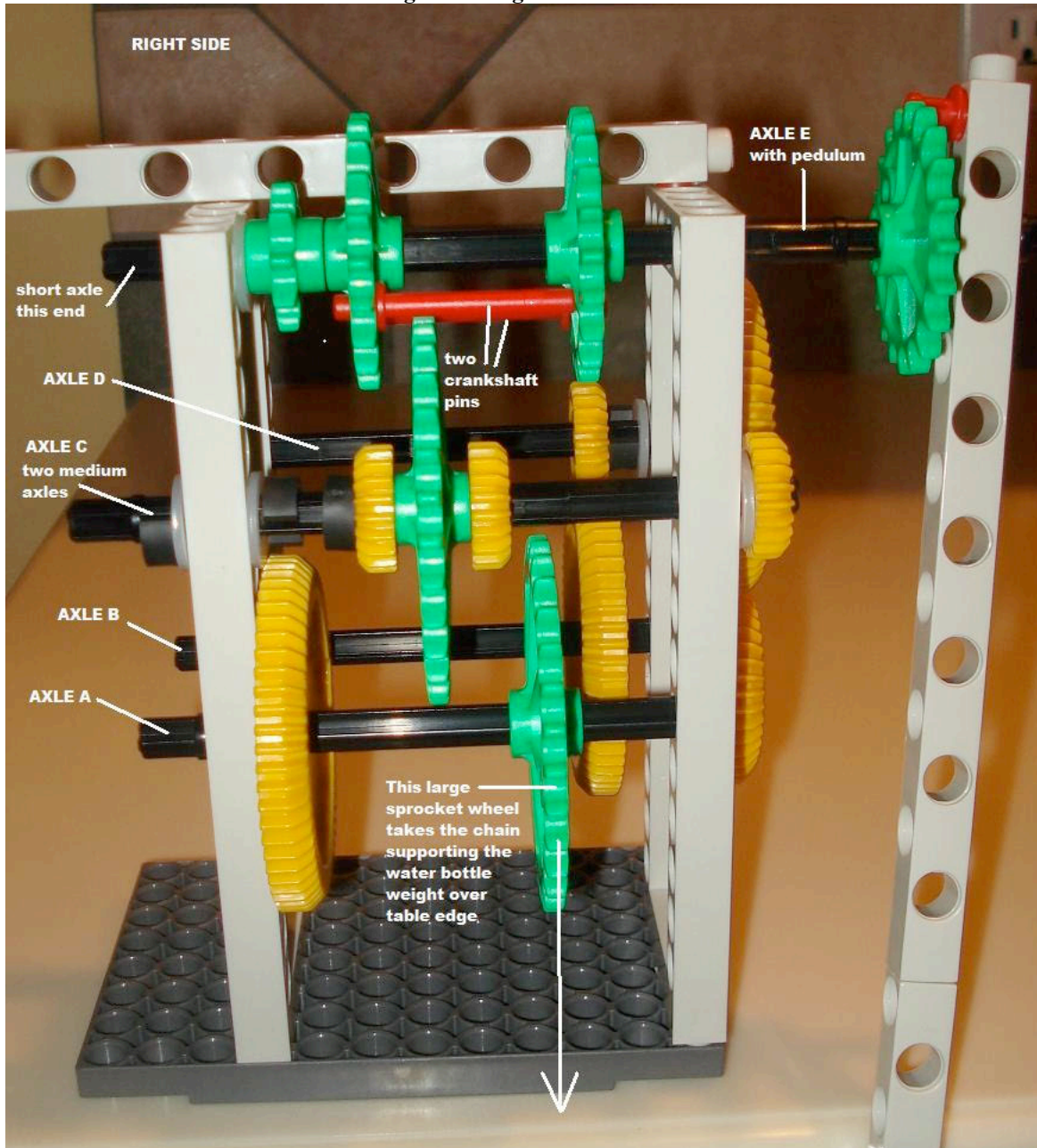


Figure 6 - Top View Axles

