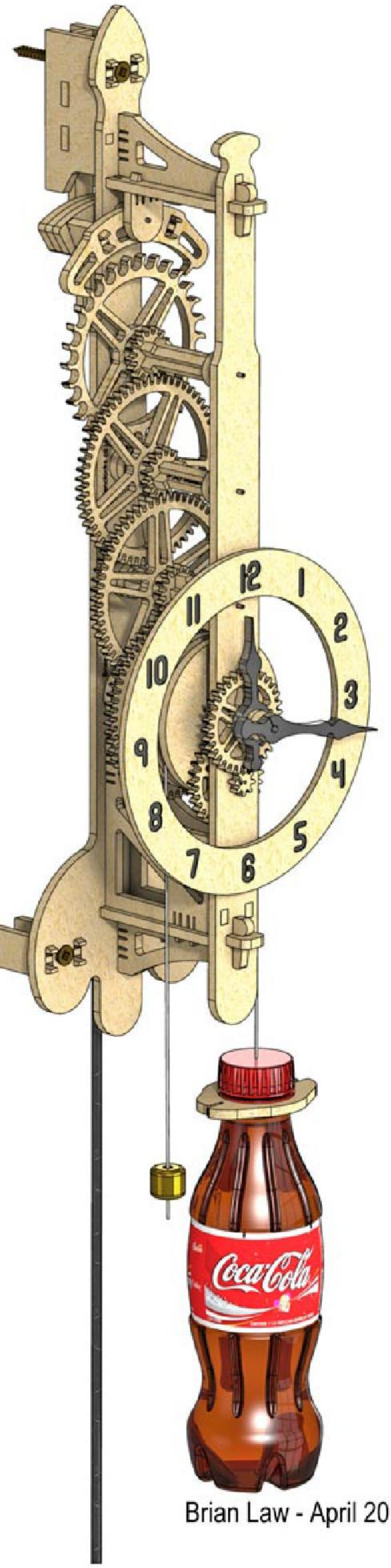
Brian Law's Wooden Clock 21 - Snap together Clock

Instructions for the construction and assembly.
With notes on materials and consumables
required for the construction of the clock



Brian Law - April 2015

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This is a clock designed to be built using a CNC Laser with the minimum of other equipment requirements.
It is primarily a clock for the first time builder who wants to get hands on experience of clock building with the minimum of time and equipment. Most of the parts are cut from a single sheet of MDF measuring 400mm wide by 600 mm long and 4mm thick, with the minimum of other parts and materials. This clock is not designed to be particularly durable nor will it be particularly accurate, if you have built it according to the instructions it should run for about 8 hours, it rather depends on how high on the wall it is hung.
What it is designed to do is to introduce you to the fascination of clocks and clock building, and it will do this by allowing you to very quickly cut out all of the parts and then put them together and get it working all inside a single day. By using the CNC laser to cut out all the parts in one go it seriously reduces the time needed to complete the task of building a wooden clock. These instruc-tions give you an illustrated guide on how to complete the con-struction. What it can't do is to tell you how to use your CNC laser, so all the setting up for the machine and the offsets you need to apply to the beam so that it can know when its cutting the outside of a profile or the inside of a hole is entirely up to you, although some guidance is given in the hints and tips section. The drawings on the following two pages show firstly all of the parts laid out on the 400 x 600 sheet of MDF. The various sub assem-blies are colour coded so that you can see where each of the parts will fit in the final clock shown on the next page. Following that is a more detailed set of instructions for the assembly itself.
So read through these instructions and familiarise yourself with the parts and where they fit, collect your materials together and download the DXF files to feed to your CNC Laser software, and build your clock.

Brian Law's Wooden Clock 21 - Snap together Clock Equipment

The following equipment is desirable :-
CNC Laser
Drill -Power or Hand
Drill Bits in the following sizes, Ø1.6, Ø1.9, Ø3.0 and Ø 3.1 . Actually these are not entirely necessary as you can make adjustment to your beam setting to get the holes to the right size. The pin holes in the end of the gear assemblies need to be a tight fit as do the Pendulum head and the escapement on their pivot, but the pivot holes in the frame all need to be a loose fit.
Hand tools all the normal things that are used in the workshop, Files, screwdrivers hammers, pliers etc.
Consumables Sand paper 80 grit for general cleaning up and 600 grit for cleaning the tops of the Escapement teeth and the Pallets.
Gorilla Glue ,PVA, and Dry Film Lubricant in a spray can for the gears after everything is finished.

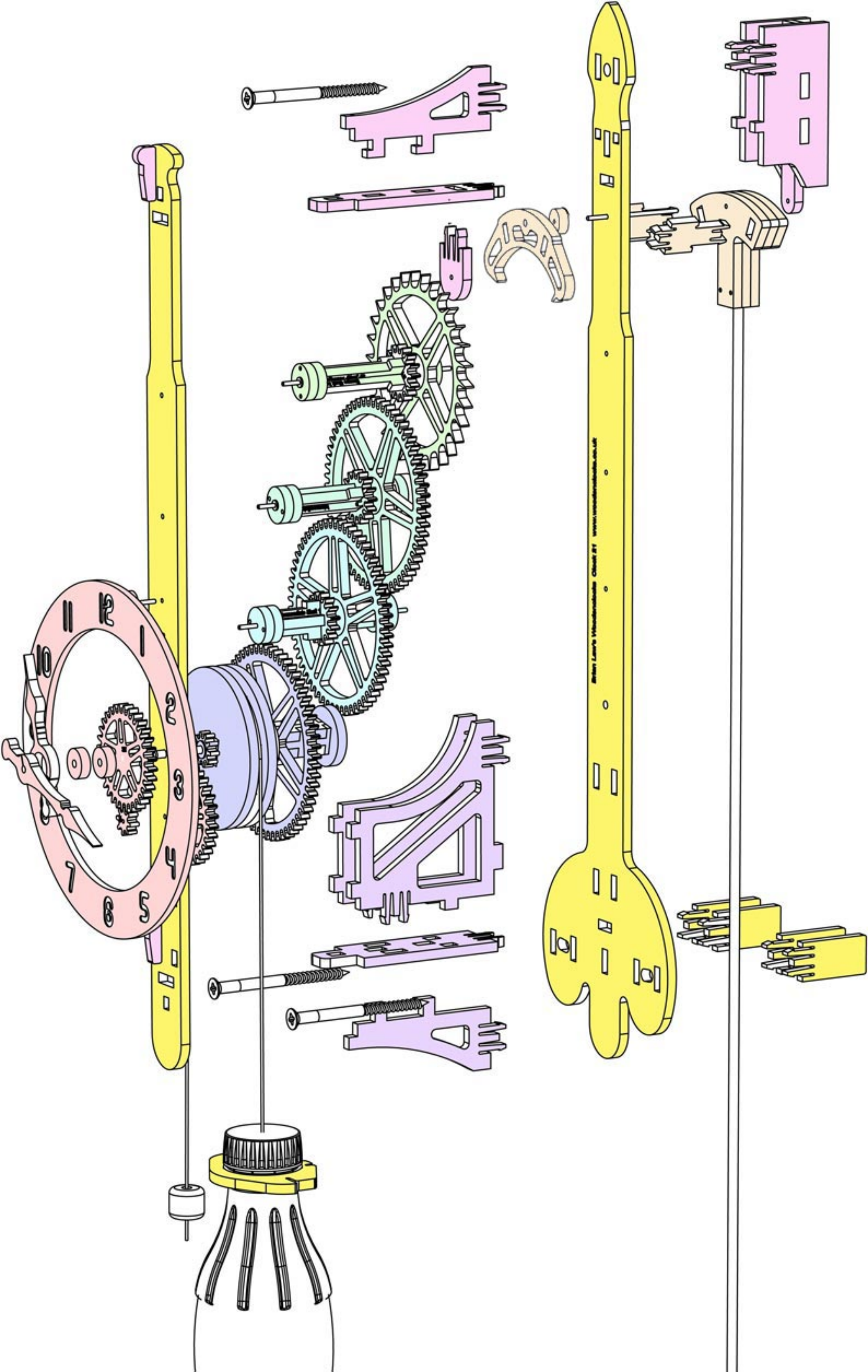
MATERIALS
For all the wooden Parts

The choice of material to build the parts from is limited and it is intended that you use 4mm thick MDF, you could try other materials but they do have to be 4mm thick as the slots used throughout the construction are designed for 4mm material. The Blank size is a nominal 400mm x 600mm to contain all of the components, you can of course use smaller blanks but you will need to use your CAD or Laser software to move the parts into other blank sizes and/or configurations.
It is worth noting that the burnt finish produced by the Laser is actually carbon and will act as a lubricant, so it doesn't need to be removed. The only place that you will need to clean up is the teeth on the Escape wheel and the ends of the two Pallets. These experience quite a bit of friction and as this is a very sensitive area of the clock it is best to minimise the friction as much as possible. A spray with dry film lubricant after cleaning with 600 grit sandpaper is desirable.

For all the other parts

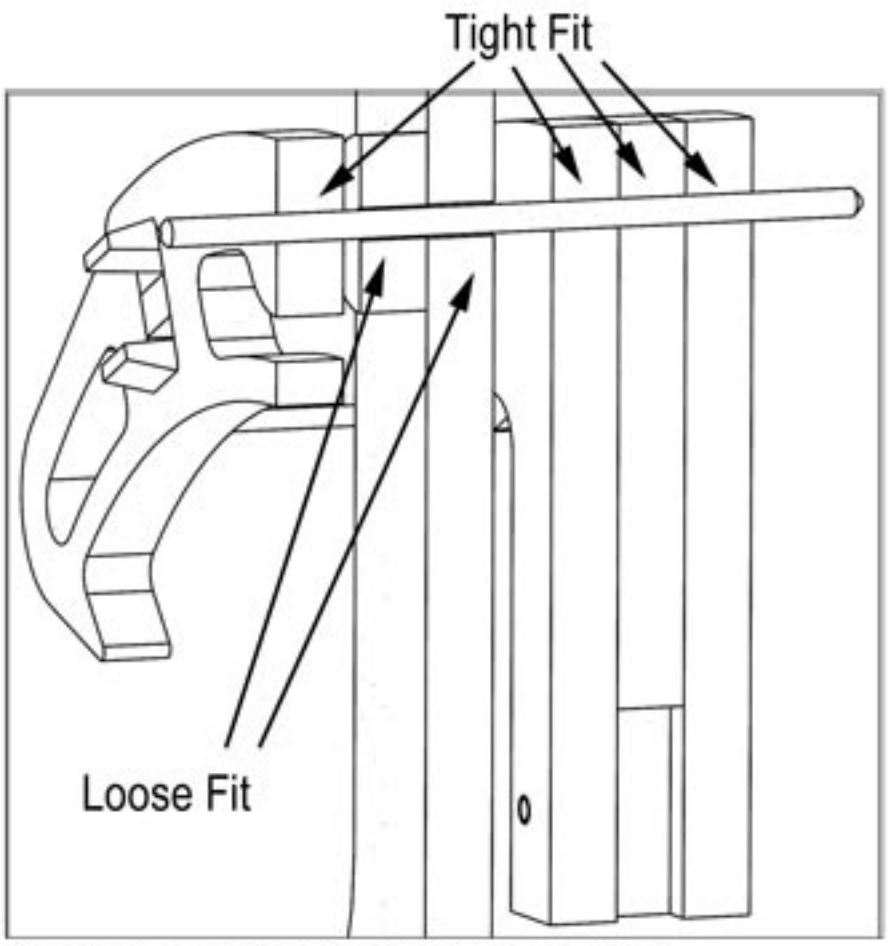
Ø1.6 mm (1/16") Panel pins or nails cut to length as required.
Ø1.6 mm (1/16") wire 45mm long for the Pendulum and Escapement Pivot.
Ø3 mm (1/8") steel or Brass rod for the Drive assembly pivot.
Ø2mm washers 0.3mm thk
Ø3mm Washers 0.5mm thk
2 meters of Venetian Blind cord a maximum of Ø1.2 mm diameter for hanging the weight.
500 ml Bottle with 28mm neck, used to hold the water that acts as the weight.
Various steel nuts or washes weighing around 22-28 grams (1 oz)
3 Woodscrews Ø4.5 x 60 mm
Carbon fibre Tube Ø4 mm x Ø2 mm bore x 1150 long. or 4mm wooden Dowel(Craft shops or Kite material suppliers)
Wood glue for gluing parts together where required.
Gorilla Glue to glue the Carbon Fibre Pendulum rod into the pendulum head.

Clock 21 Laser Cut Profiles.
Brian Law's Woodenclocks
14-4-2015

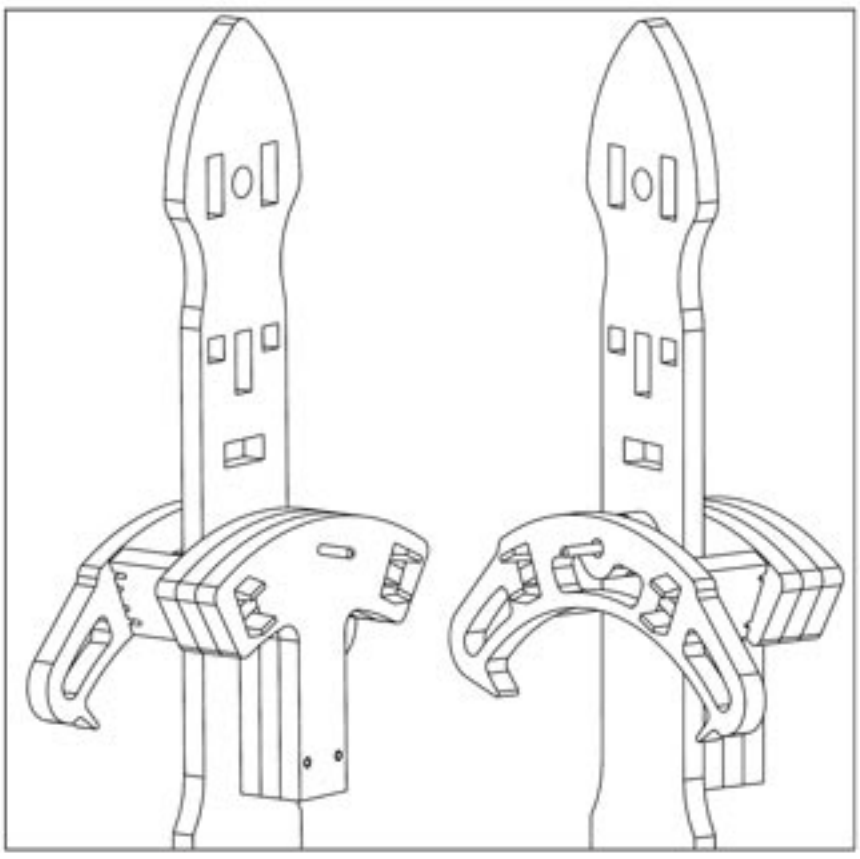

Brian Lane's Woodentimetable Clock #1 www.woodentimetable.co.uk

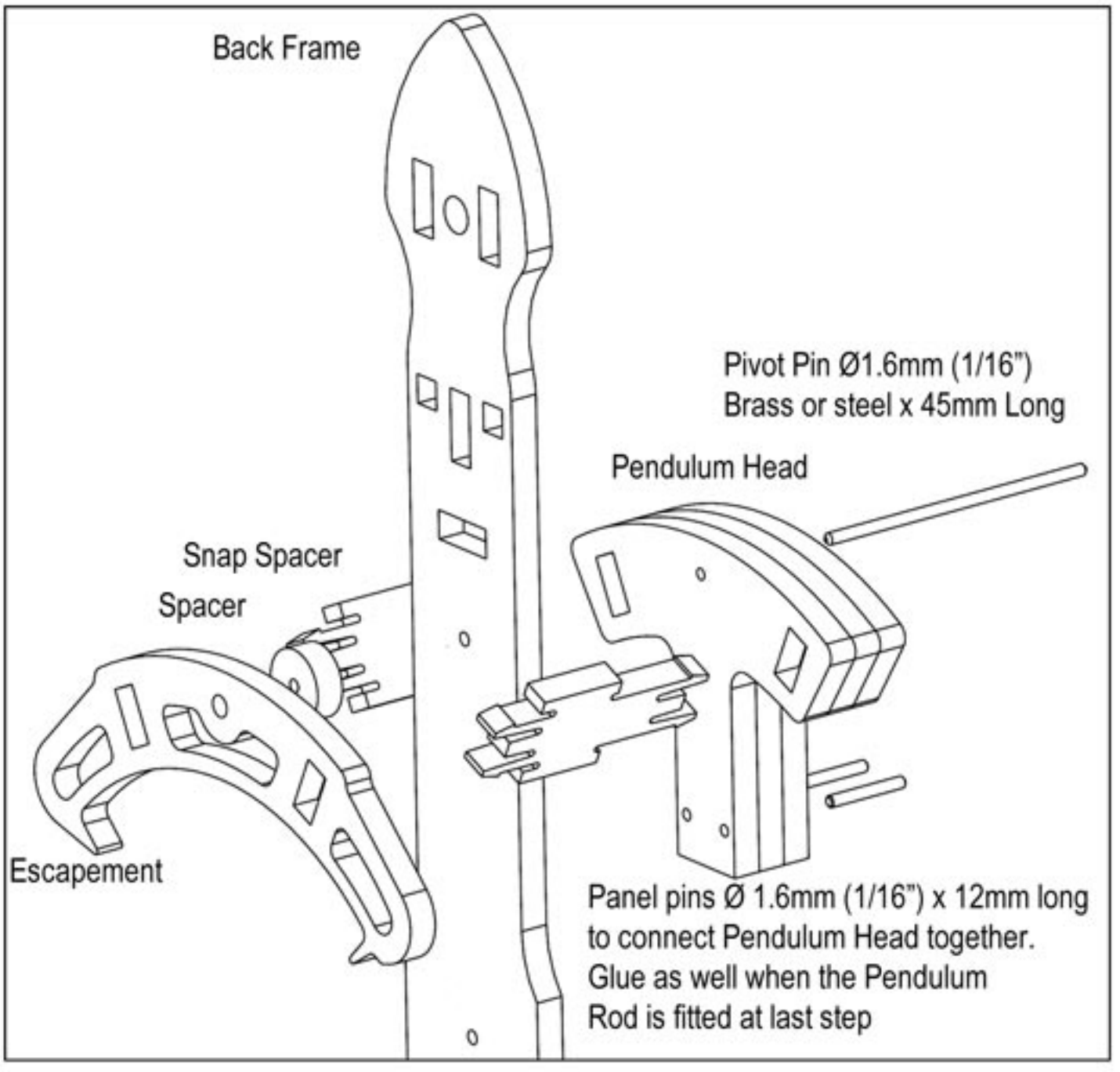
Brian Law's Wooden Clock 21 - Snap together Clock
Assembly Sequence

Stage 1 Assemble The Escapement and the Pendulum Head around the Back Frame



Section showing the fits for the pivot.





Assemble the parts around the Back Frame and use the Pivot Pin to hold the parts onto the it. The assembled parts should swing freely on the pivot pin. This sub assembly should be rigid when snapped together, if not, use glue to ensure that it is.

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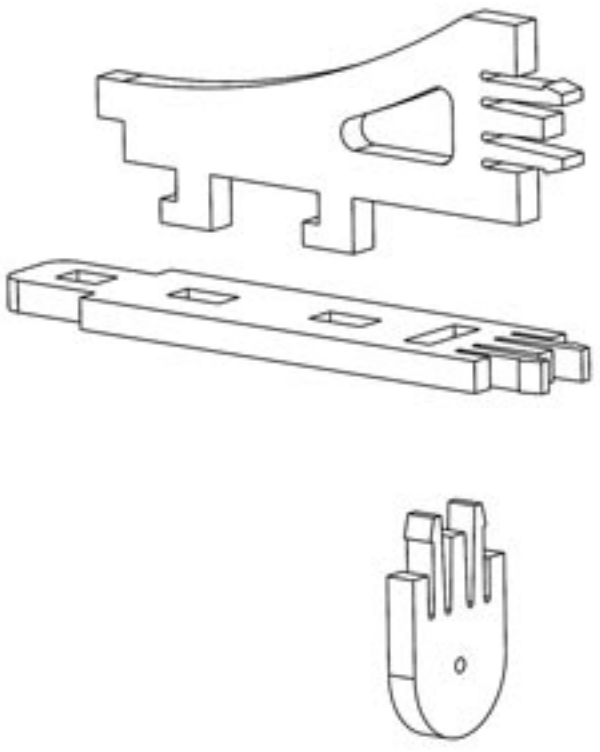
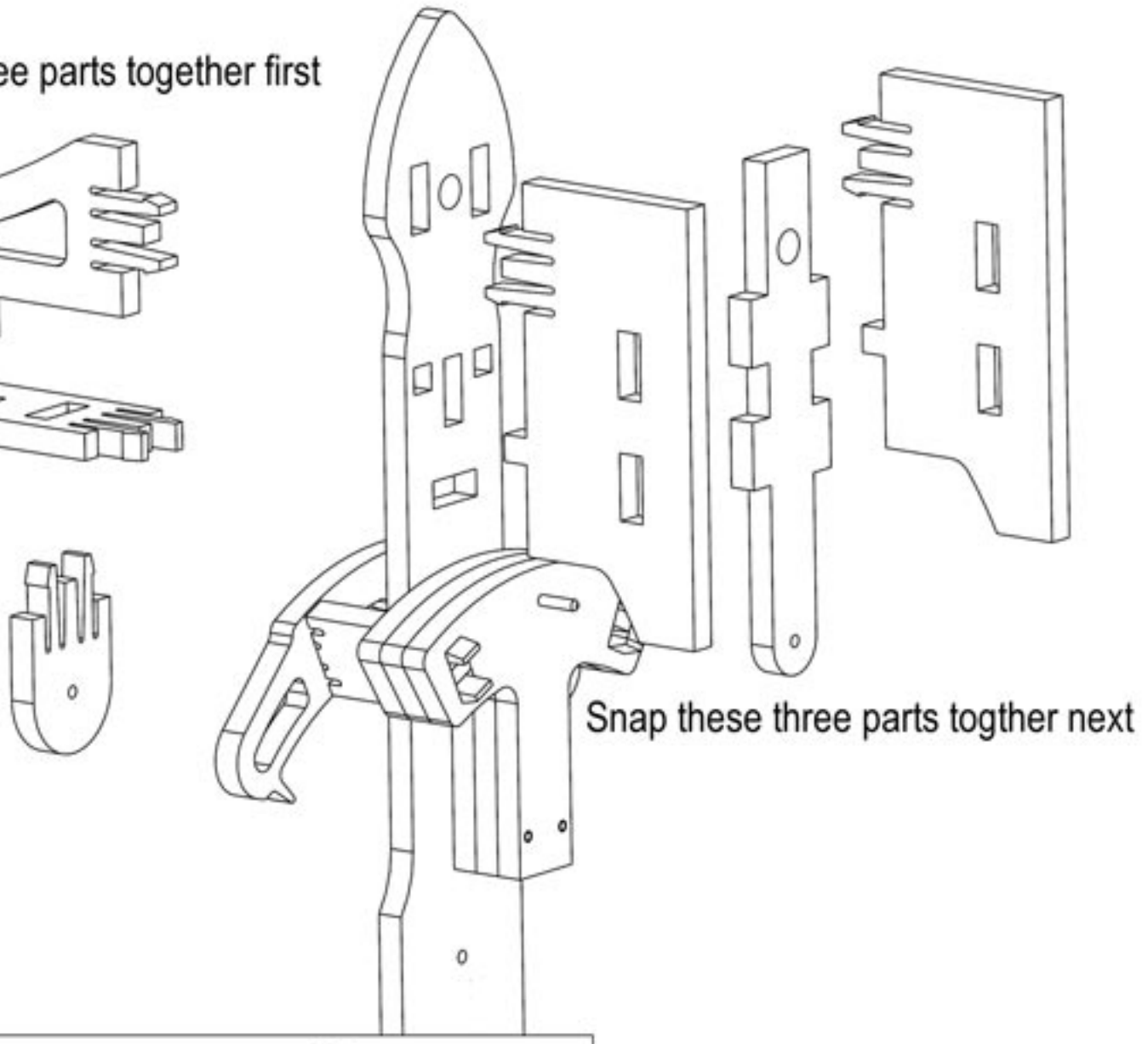
Brian Law's Wooden Clock 21 - Snap together Clock Assembly Sequence

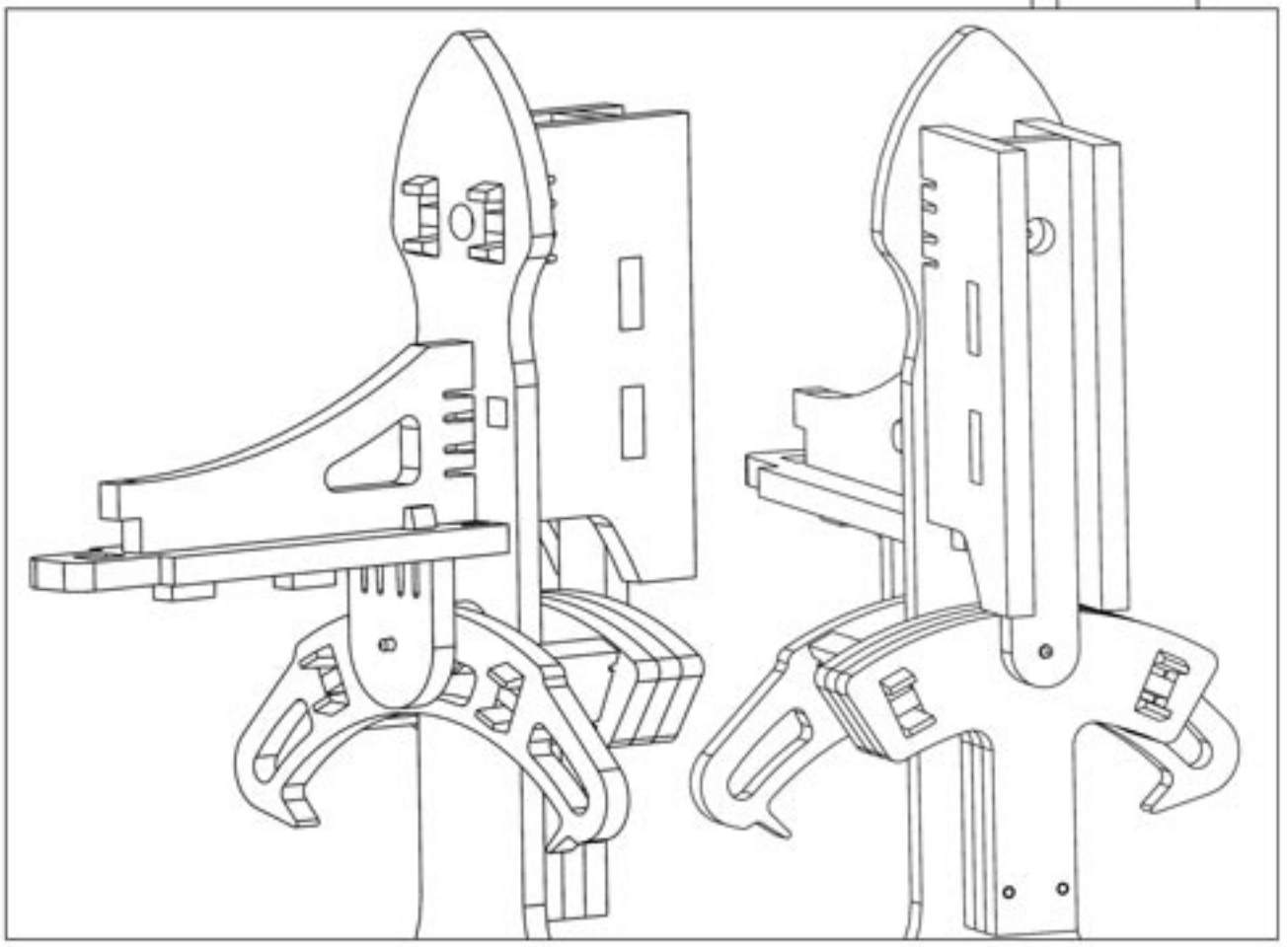
Stage 2 Assemble all Snap on parts to the top of the Back Frame

Snap and **Glue** these three parts together first





Snap these three parts togther next



Finally snap the sub assemblies to the Back Frame This sub assembly should be rigid when snapped together, if not, use glue to ensure that it is.

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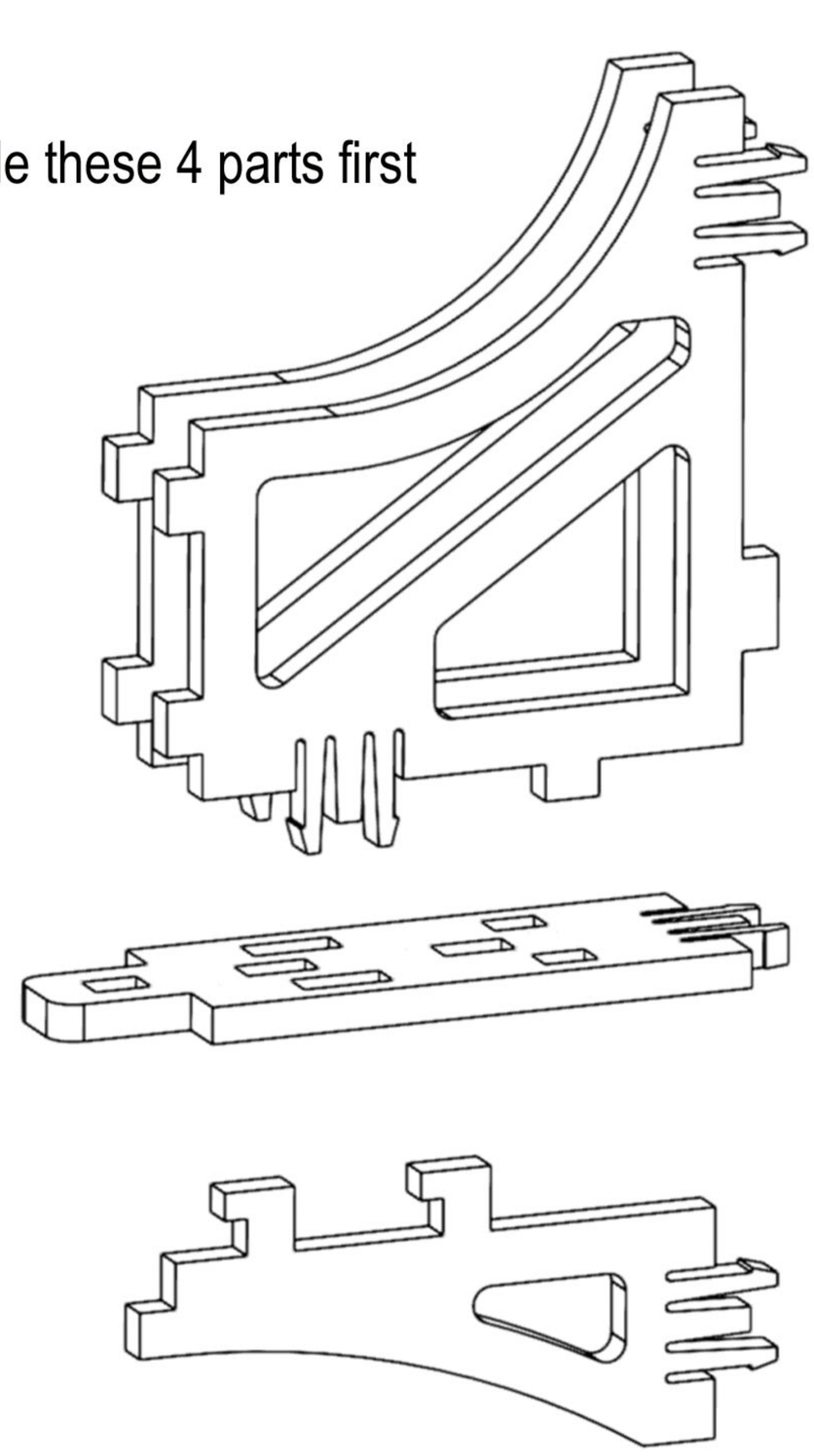
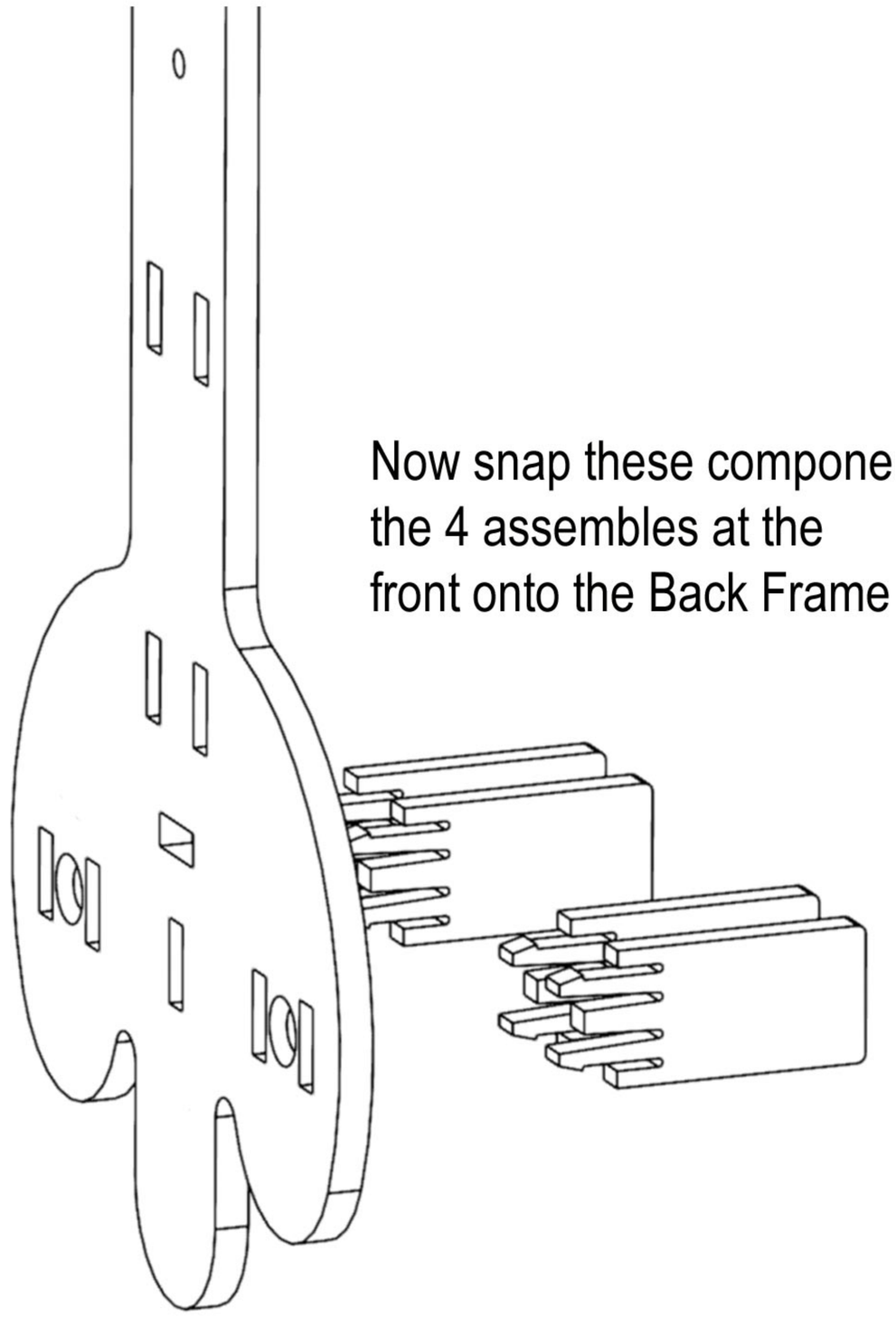
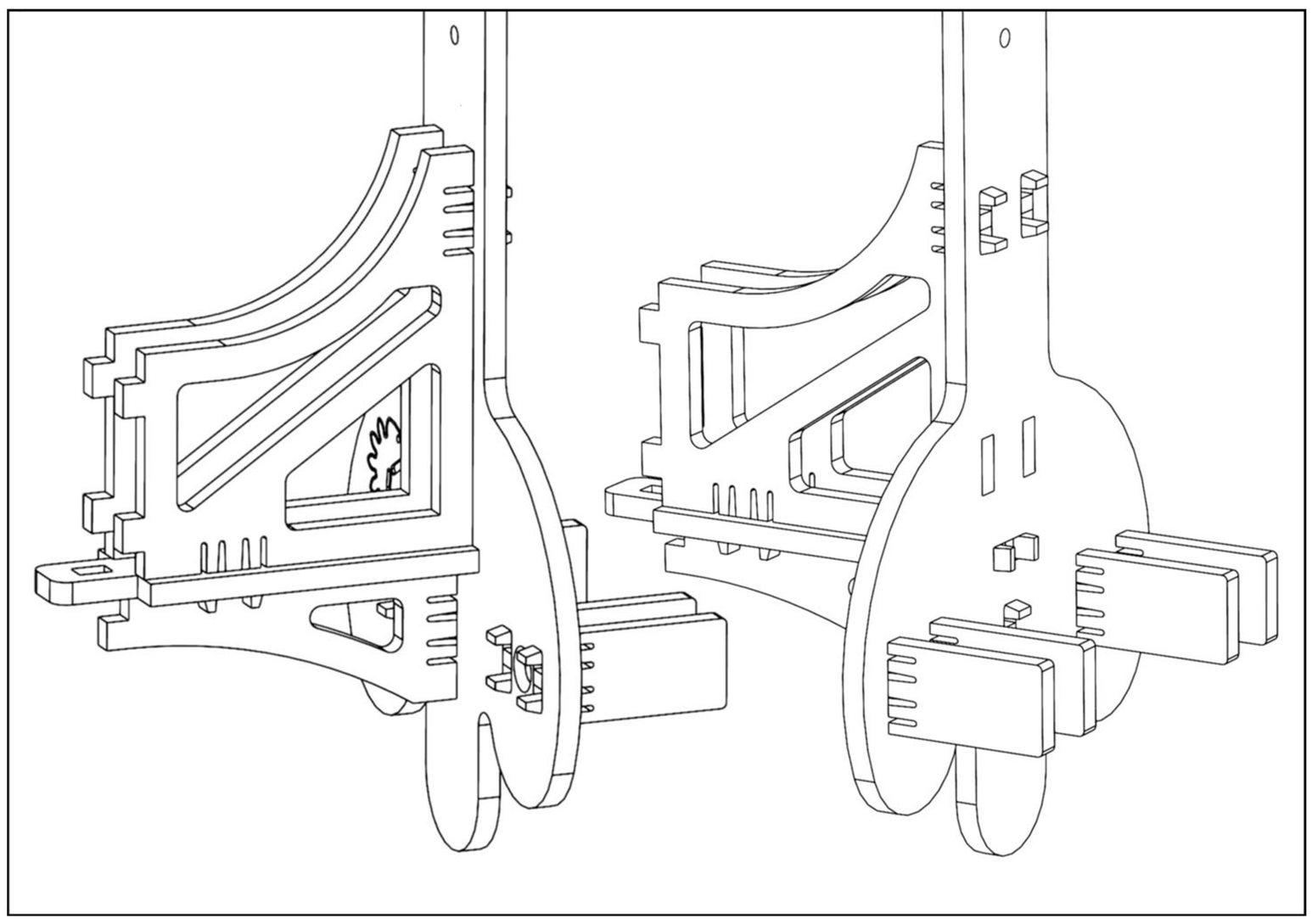
Stage 3 Assemble the support parts to the bottom of the frame.

Assemble these 4 parts first





Now snap these components and the 4 assembles at the front onto the Back Frame



Finally snap the sub assemblies to the Back Frame This sub assembly should be rigid when snapped together, if not, use glue to ensure that it is.

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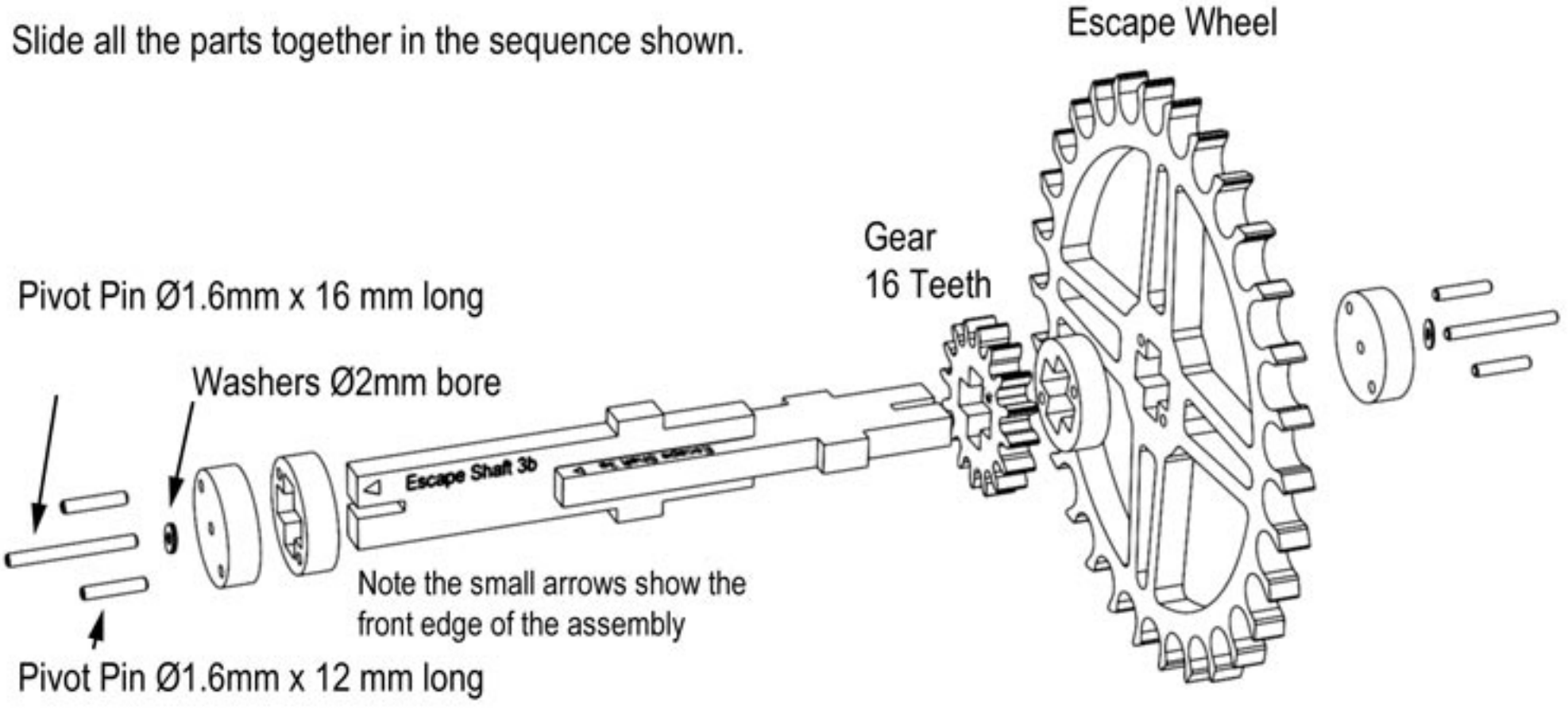
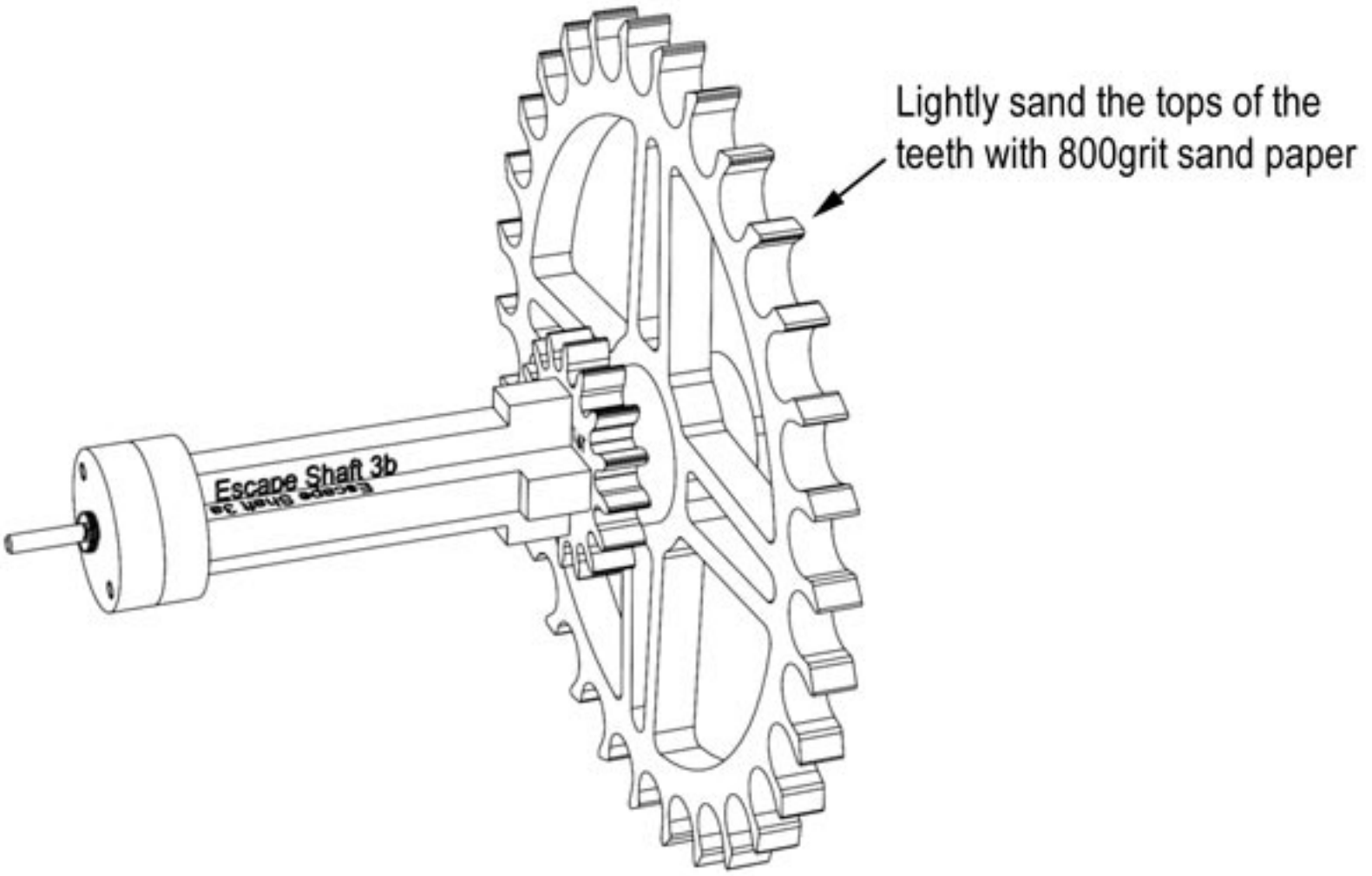
Stage 4 Assemble Escapement wheel assembly

Slide all the parts together in the sequence shown.





This sub assembly should be rigid when snapped together, if not, use glue to ensure that it is.

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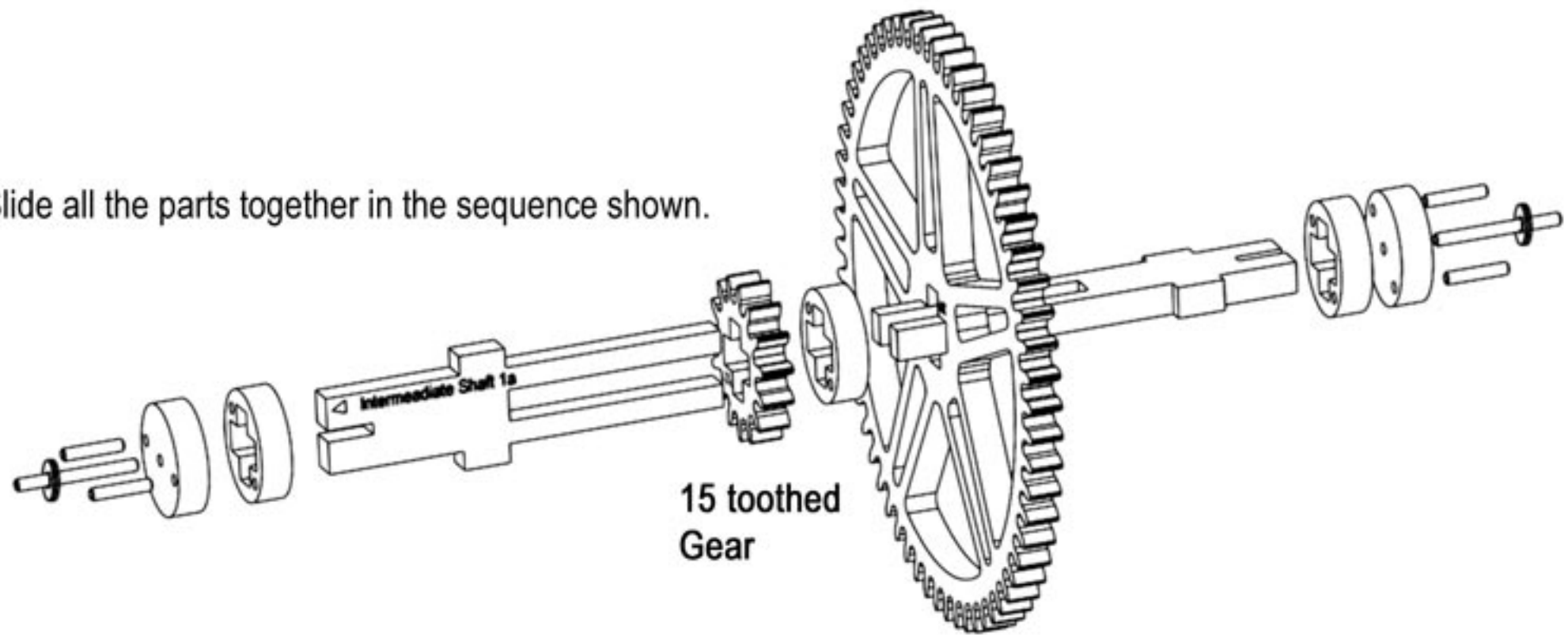
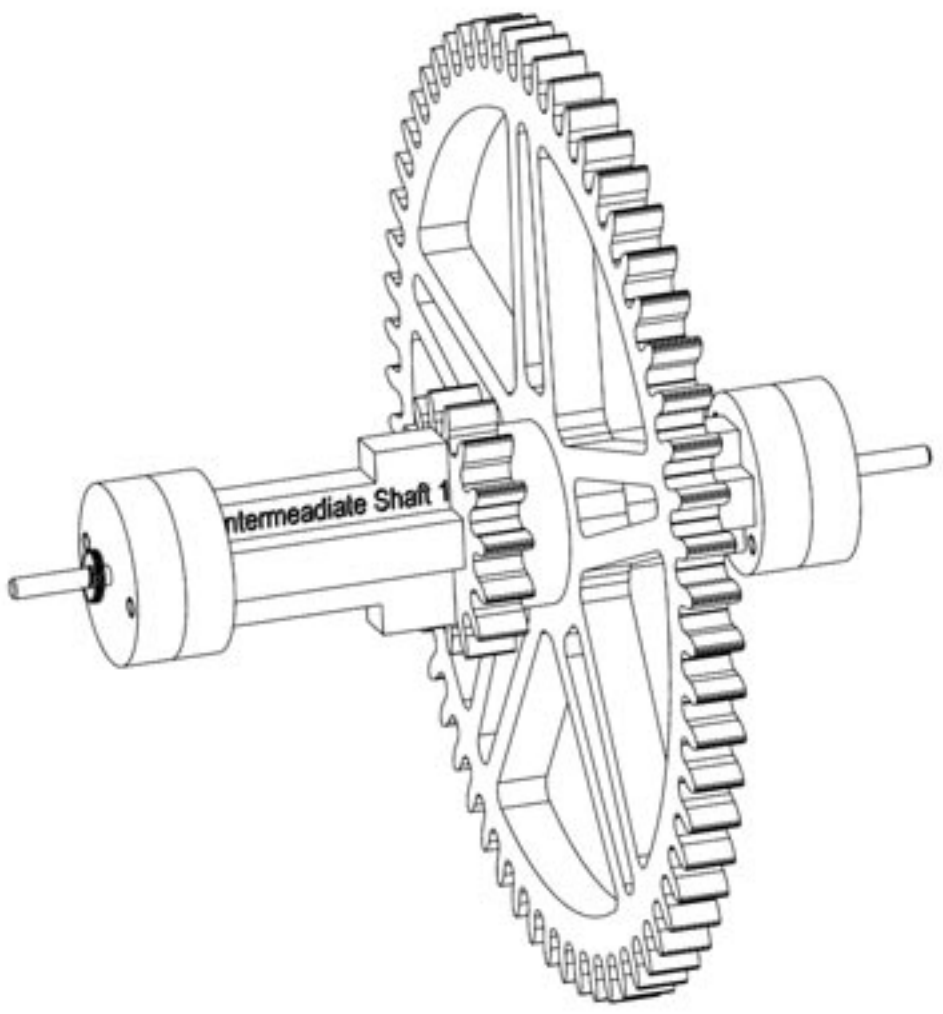
Stage 5 Assemble Intermeadiate shaft 1

Slide all the parts together in the sequence shown.





This sub assembly should be rigid when snapped together, if not, use glue to ensure that it is.

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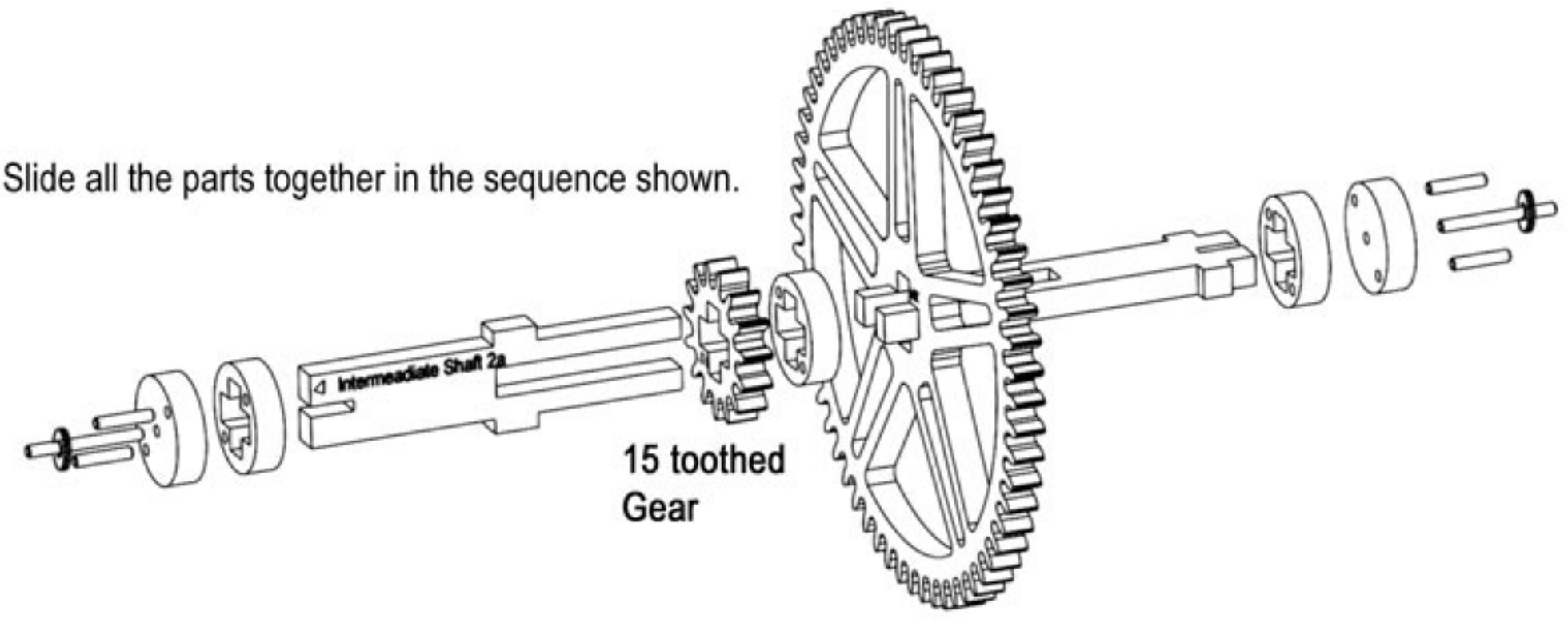
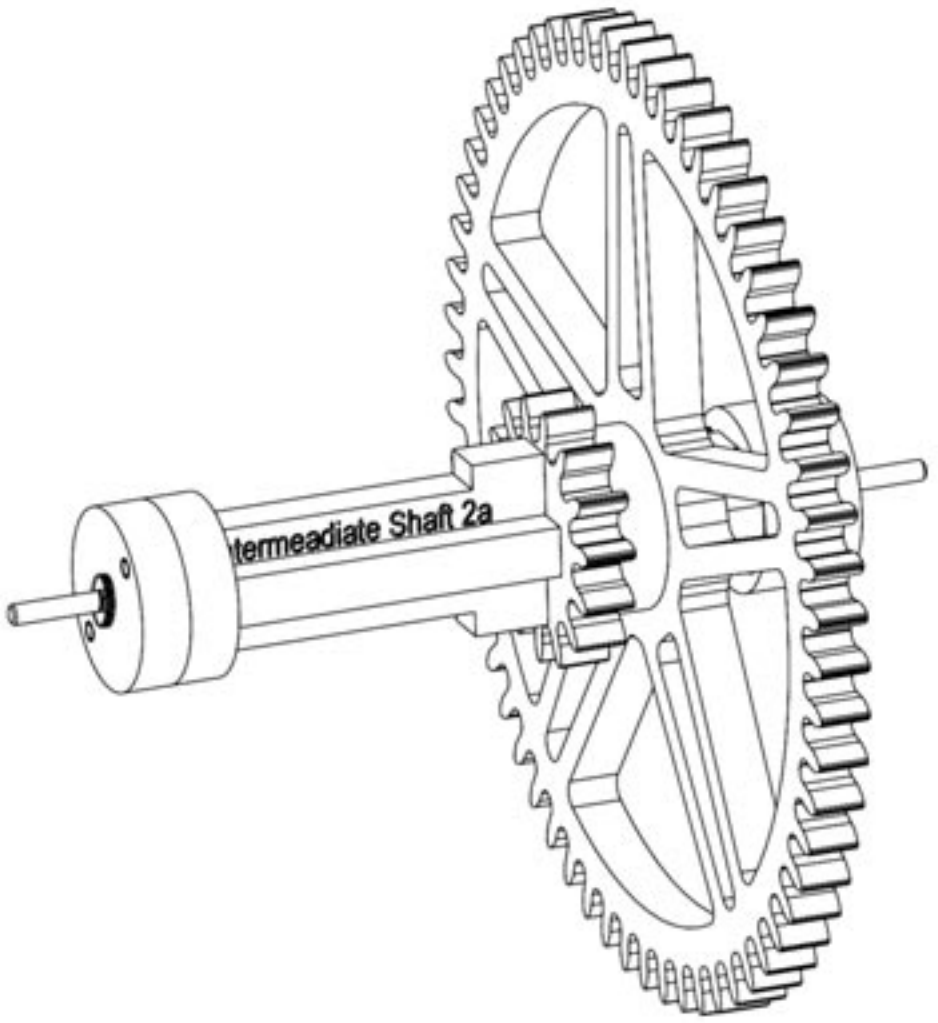
Stage 6 Assemble Intermeadiate shaft 2

Slide all the parts together in the sequence shown.





This sub assembly should be rigid when snapped together, if not, use glue to ensure that it is.

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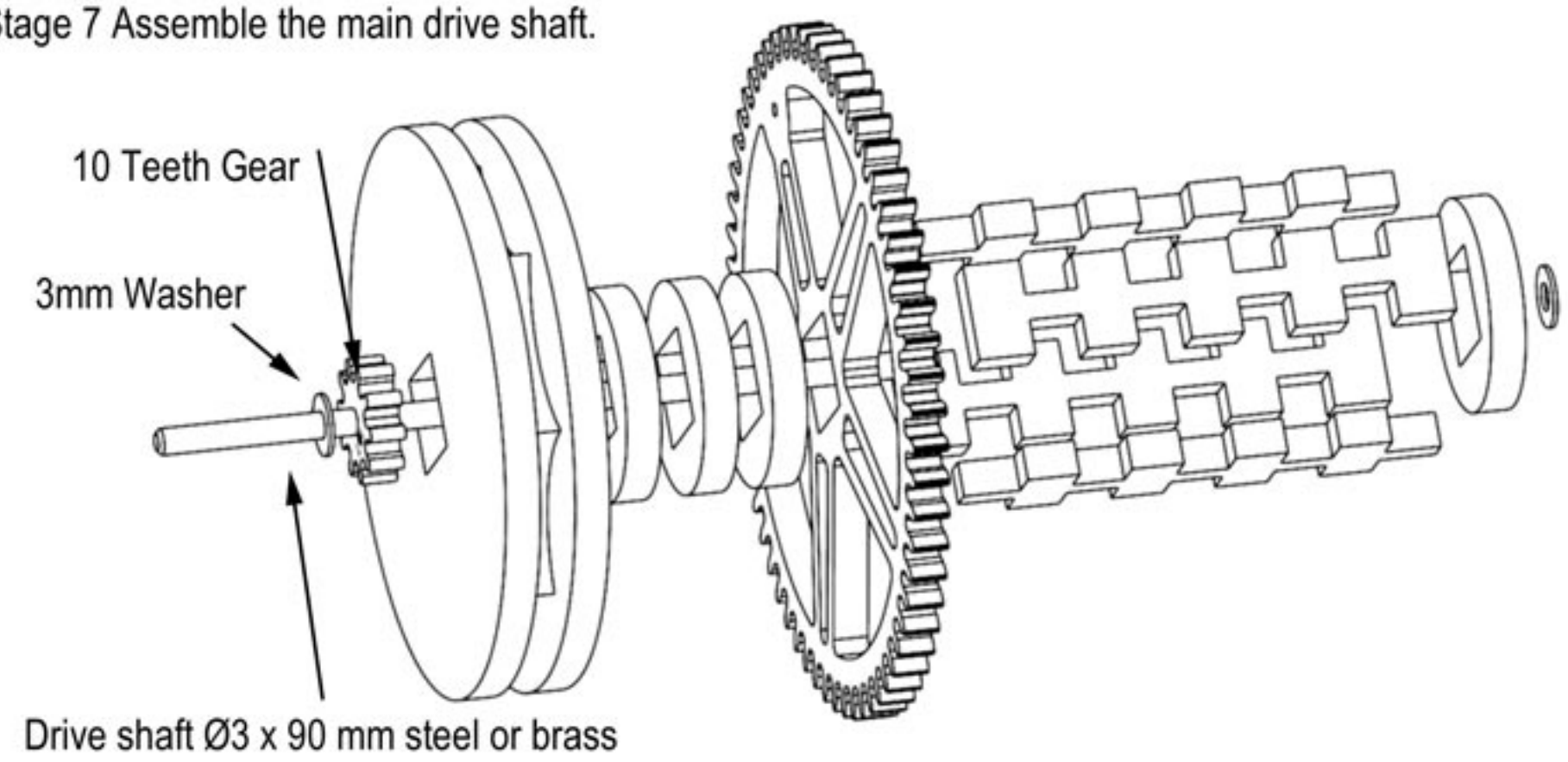
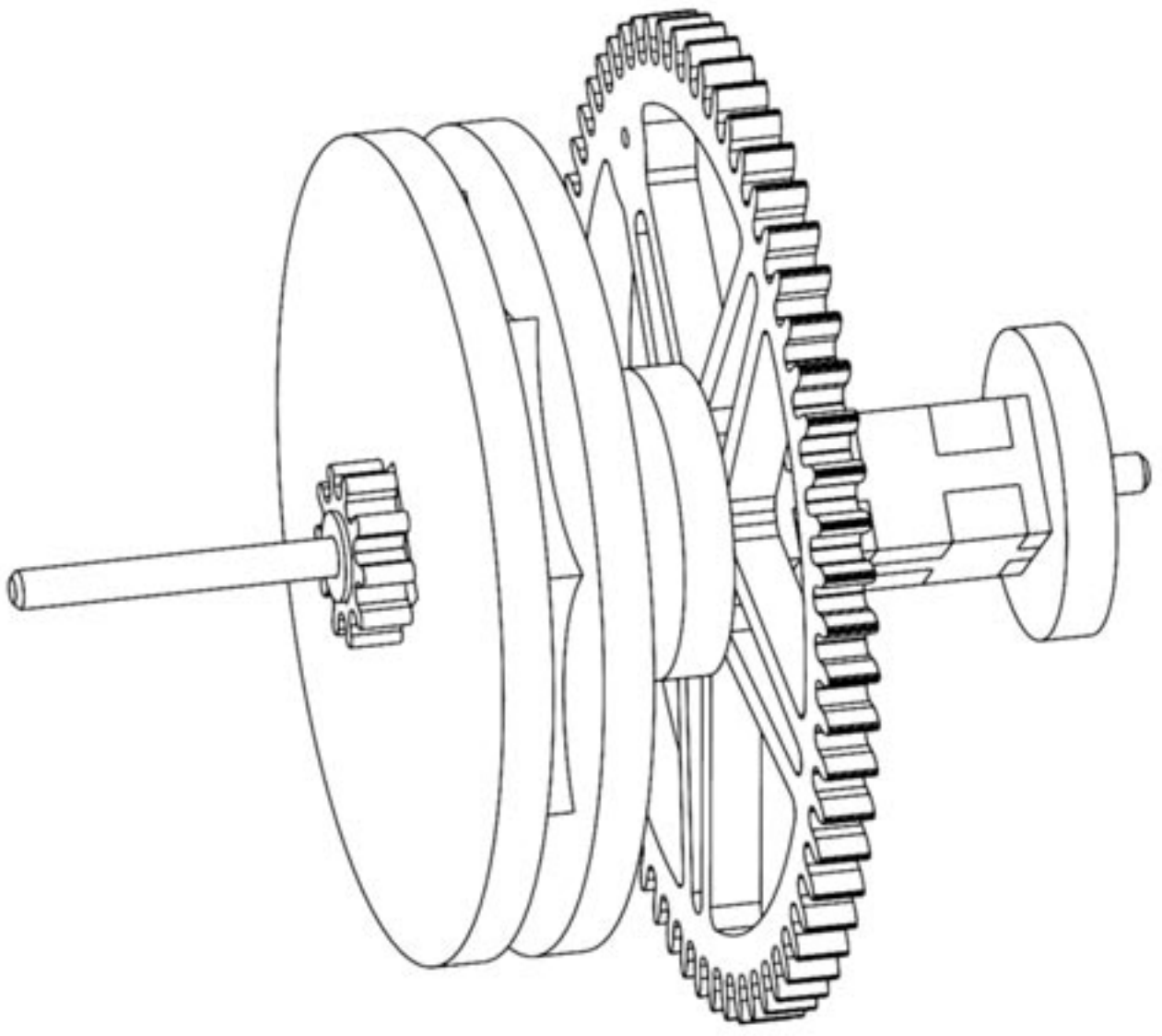
Stage 7 Assemble the main drive shaft.





Assemble the square shaft first, and this will need to be tacked together with glue. Then assemble each of the other parts onto the square shaft and glue them in position.

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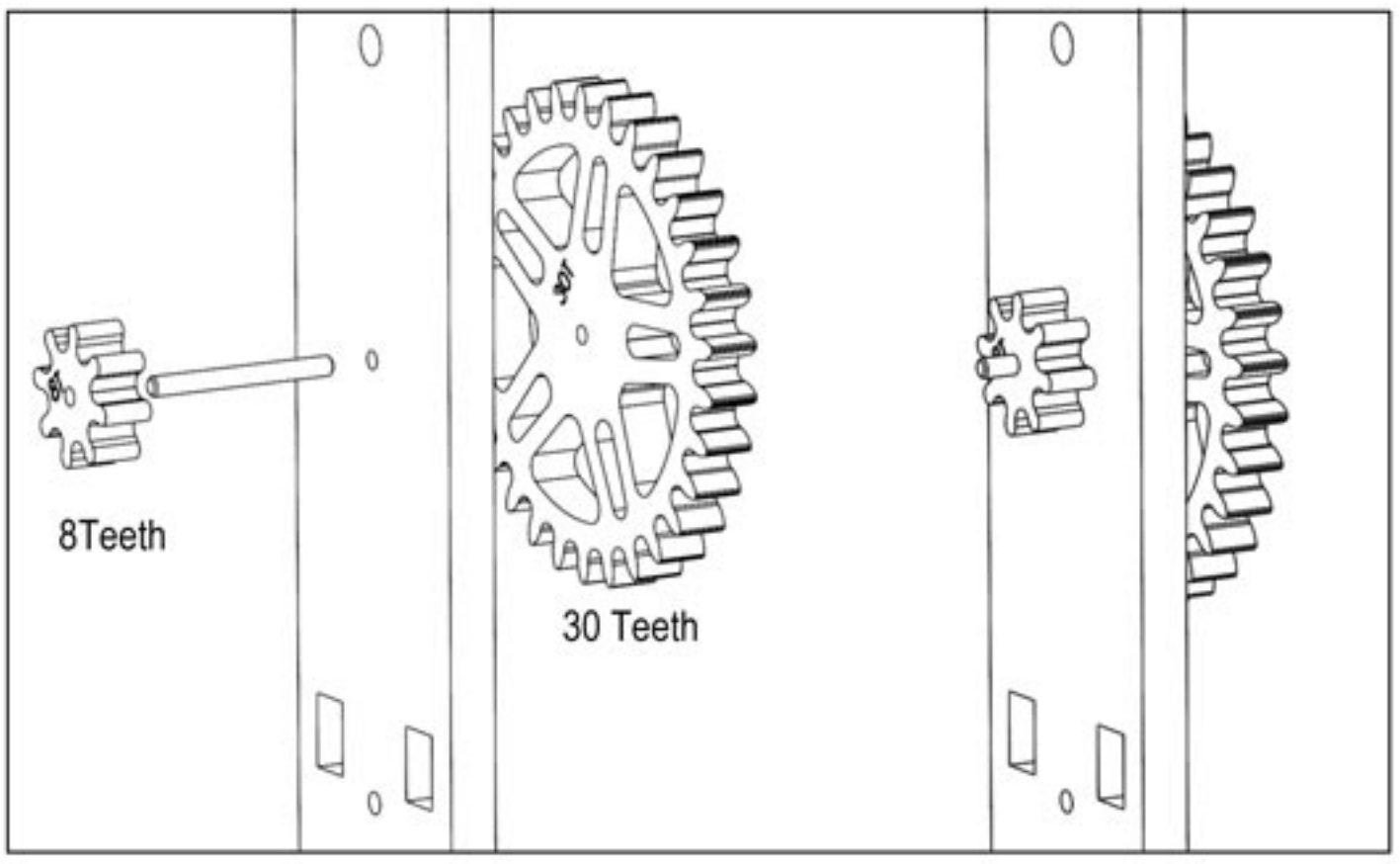
Assembly Sequence

Stage 8 Assemble The hour gears to the front Frame



Use a Panel Pin Ø 1.6mm x 12mm long for the pivot and fit the 8 tooth gear to the front and the 30 tooth gear to the back. The gears should be a tight fit on the pivot but a loose fit around the frame, so they can turn freely

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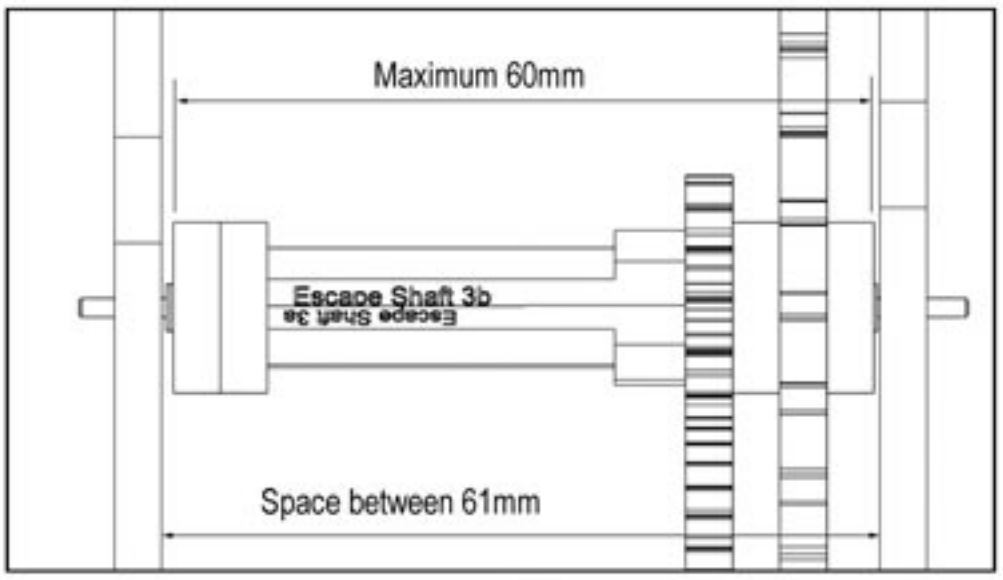
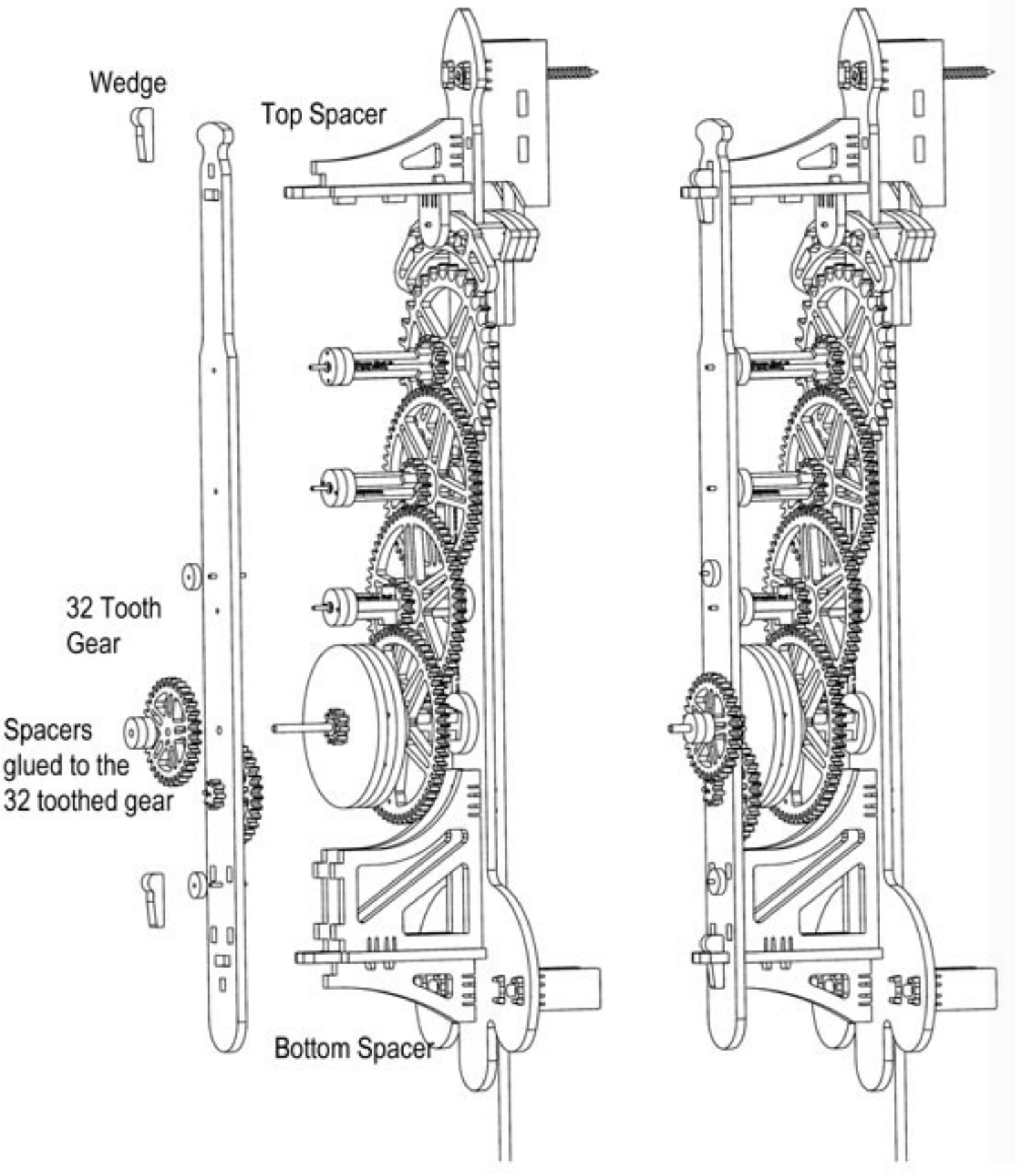
Stage 9 Assemble the Front Frame.

It is important for the free running of the clock that all the gear shaft assemblies are no longer than the 60mm shown here.
If they are longer, then file down the ends untill the length is reduce to 60mm.





Fit the front frame over the Top and Bottom spacers and slide down until it touch's the shaft on the gears, now adjust each gear set inturn to allow the shaft to slip into the hole in the frame. Now fit the wedges to lock frame in place and fit the gear and spacer to the protruding shaft . Glue the spacer to the front of the gear.

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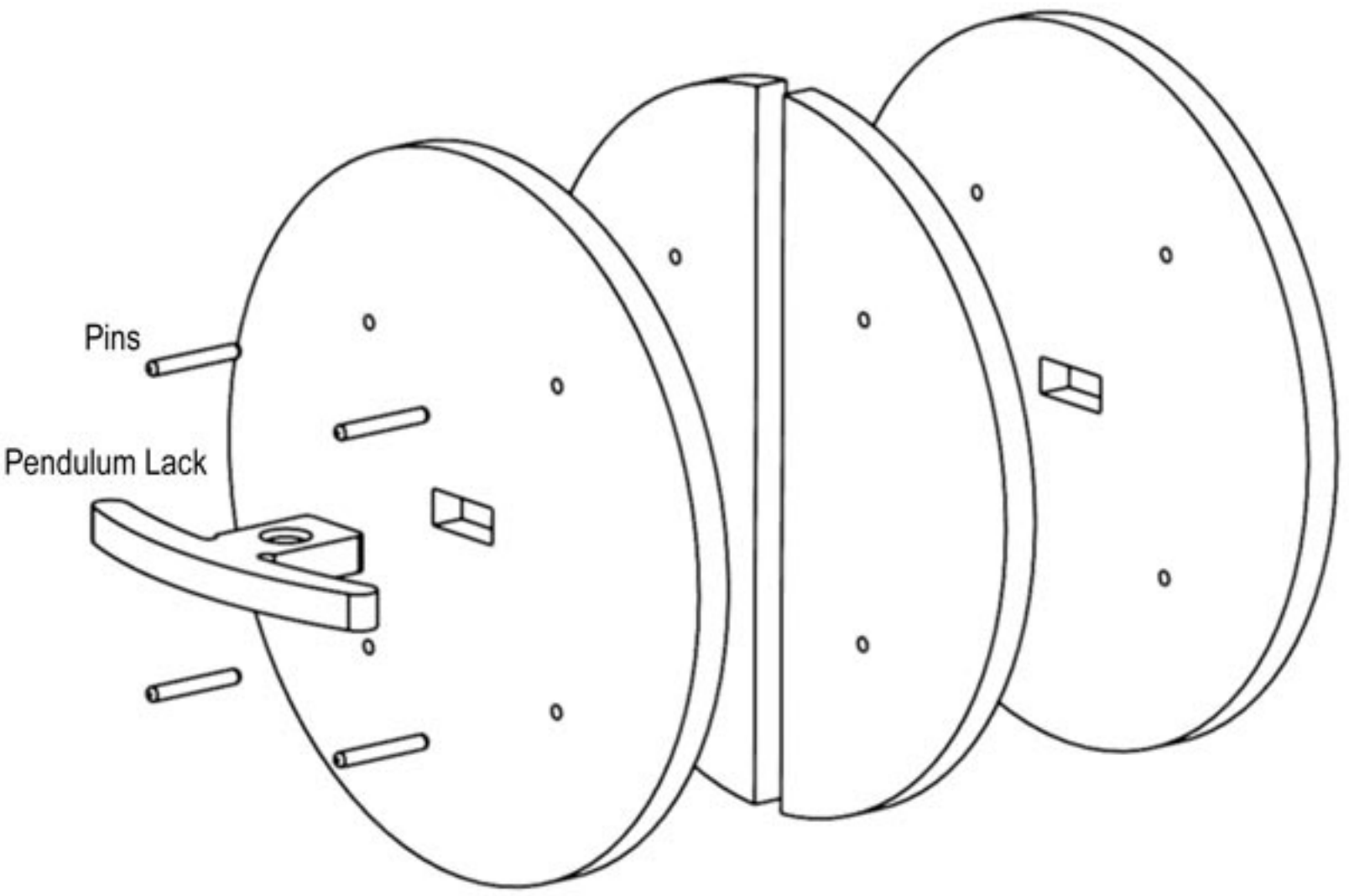
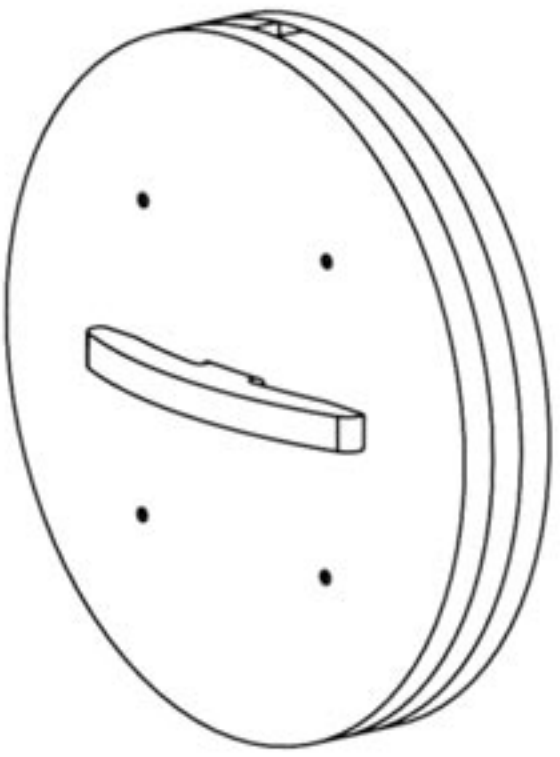
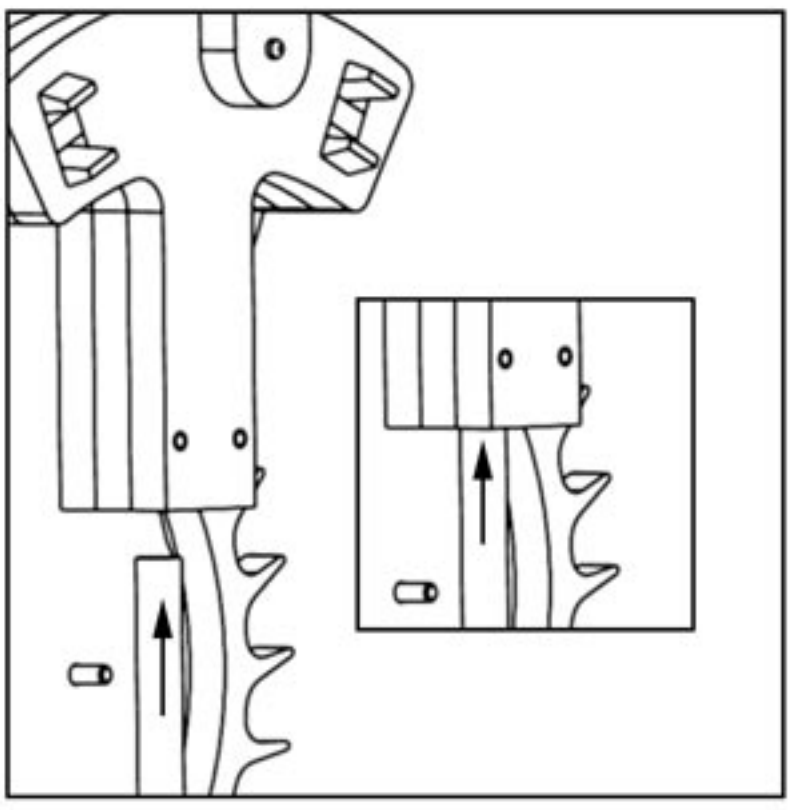
Stage 10 Assemble the Pendulum Bob and Pendulum Rod





Pendulum Rod fitted into the bottom of the Pendulum head and securing with glue.



Assemble the parts of the Pendulum Bob as shown using the pins and glue, Fit the Punulum lock into the centre, and slide onto the Pendulum Rod. You have to press the pendulum lock so it can line up with the rod before it will slip on. Chamfering the hole in the Pendulum lock will help this. The position of the Pendulum Bob can be adjusted by pressing the pendulum lock and sliding the Bob up, to speed up the clock and sliding down to slow it down.

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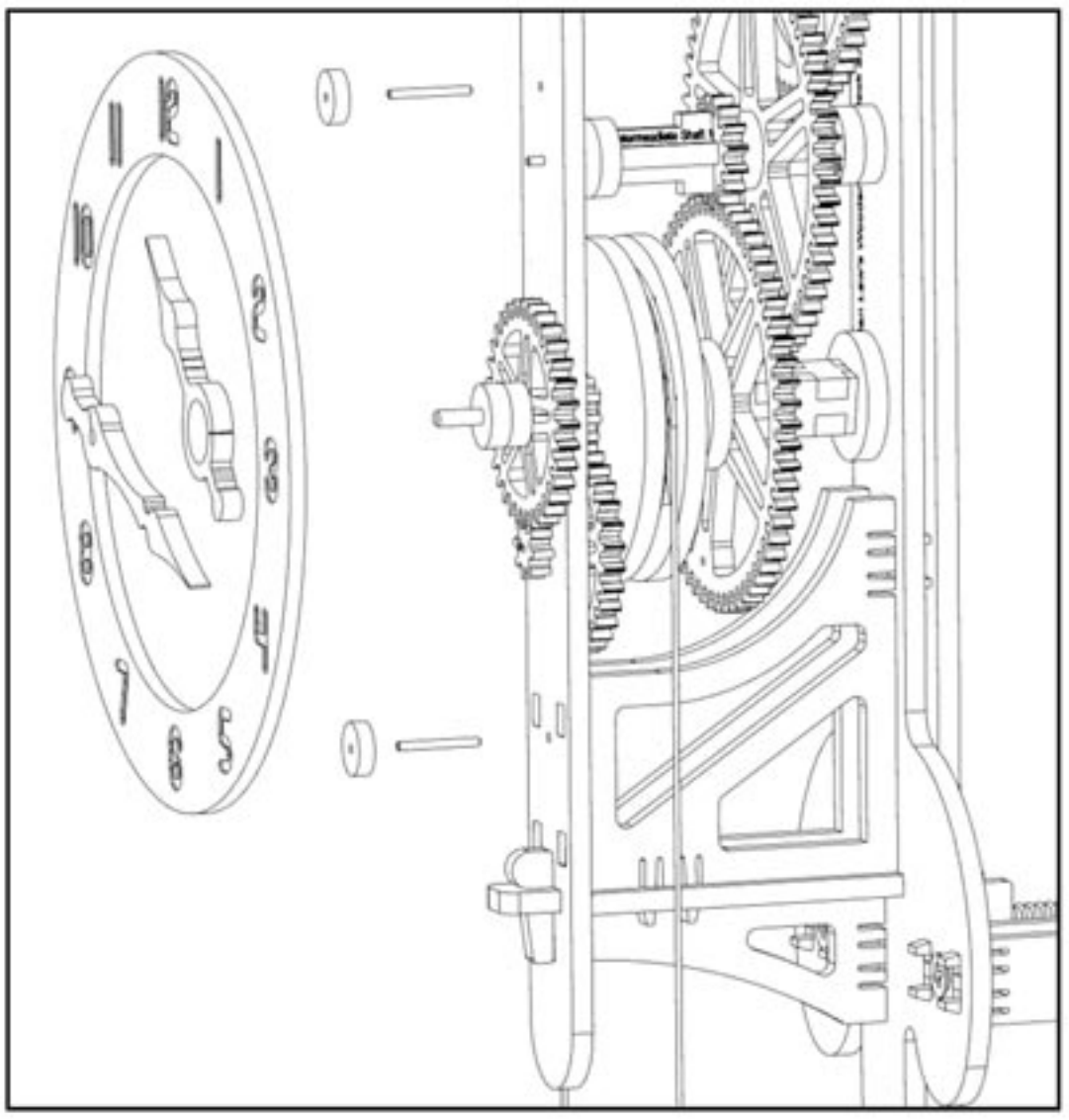
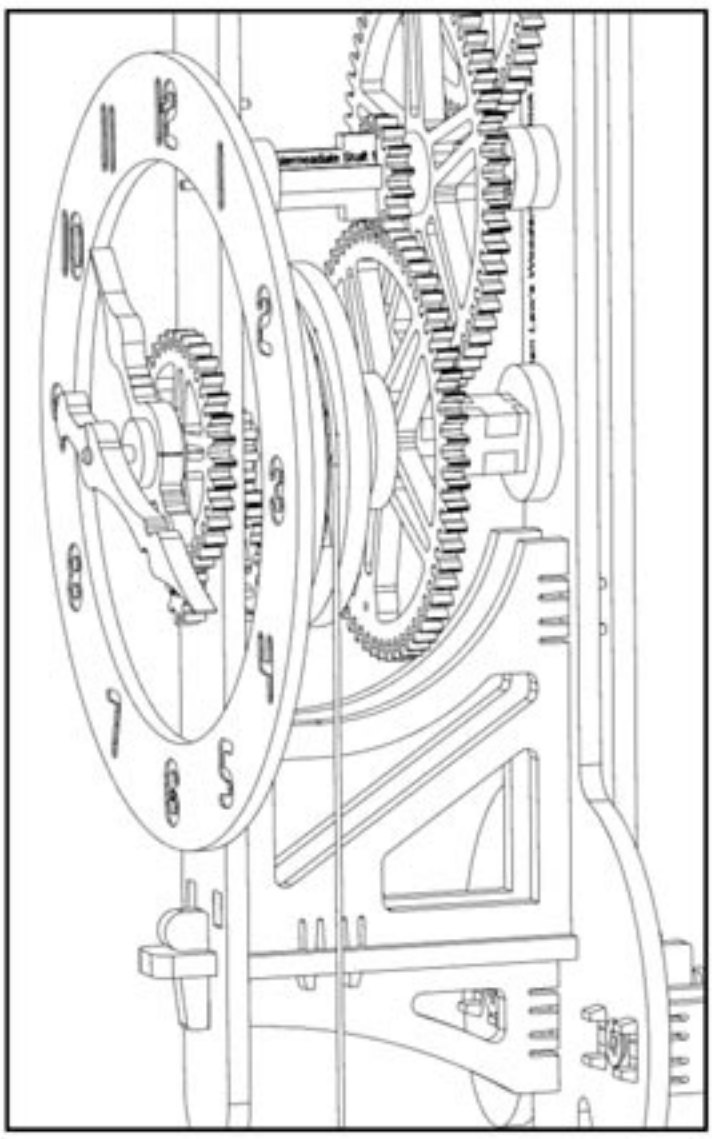
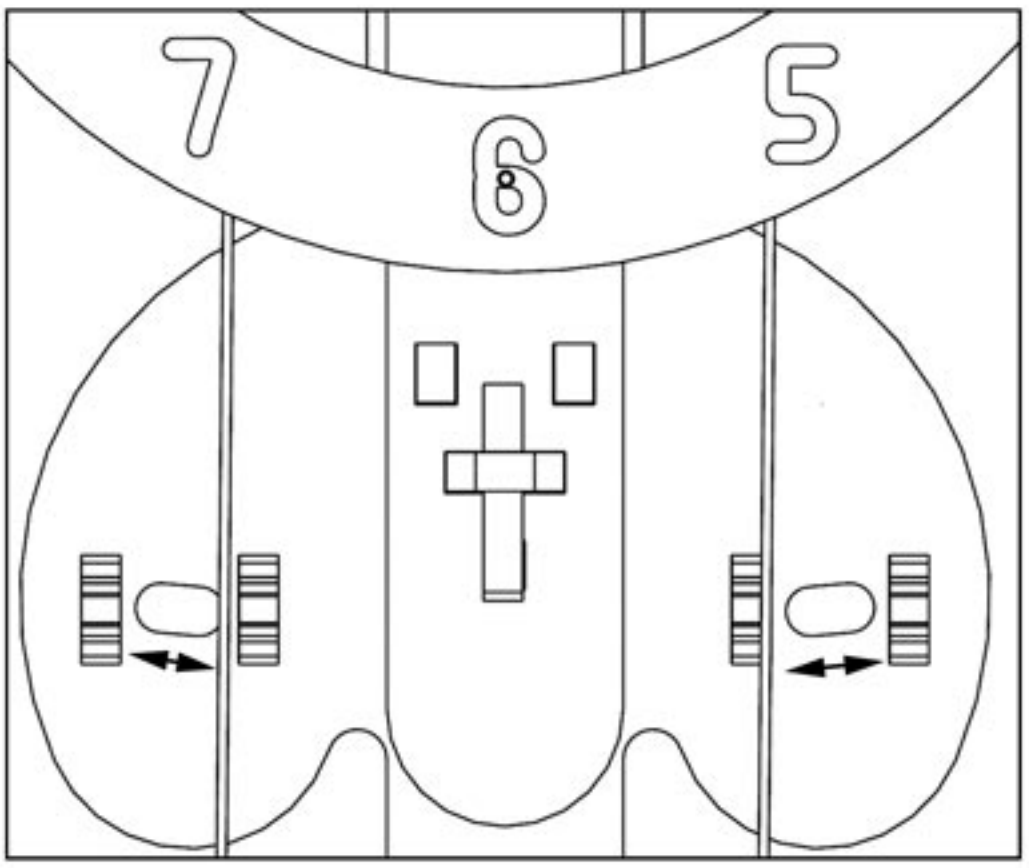
Stage 11 Assemble the Front Frame.







Assemble the Dial to the Front Frame using the 2 spacers and pins . The clock can now be screwed to the wall, make sure that it is vertical when screwed in position otherwise it will tick irregularly, and may not work at all.
NB! the two slots at the bottom of the frame for the two bottom screws, these allow the clocks angle to be adjusted slightly so as to get it ticking evenly.

Finally fit the main weight using a cord wrapped one and a half times around the drum, and fit small counterweight to the other end. The cord should be long enough to allow the weight to touch the ground when the counter weight is close to the drum, not as shown in the picture here which would be too short.

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Hints and Tips

1 - When fitting the gear sub assemblies into the frame make sure the the mating gears engage and run smoothly. The faces of mating gears should be aligned so they do not overlap eachother. There is some clearance built into the design so that when the gears are enclosed between front and back frames they are free to move without rubbing on the frames, the Ø2 washers are used one at each end to ensure that this is the case.

2 - It is important to ensure that when the clock is mounted to the wall that it ticks evenly, its very easy to here when the clock is ticking unevenly, so before fixing the bottom two screws into place swing the clock slowly to the left and right until you here the even ticking. at this point secure the clock with the bottom two screws. If after this you find that is not ticking right, you can loosen the screws and use slots around the bottom two screws to make adjustment.

3 - The driving weight for the clock is a 500ml plastic bottle with a Ø28mm neck dia. The bottle holder is fitted to the neck under the screw cap after filling it with water. The bottle holder has slots tho allow the cord to be wrapped around it and easily removed if needed. The cord itself is wrapped around the drum one and a half times so that the bottle hangs to the right when looking at the clock from the front, and the counter weight to the left. The counterweight need only be quite small and is used to prevent the cord sliding free when the full weight of the bottle is hanging on the other side.

4 - The Pendulum Bob needs to be fitted so that the centre of the Bob is approximately 1130mm from the pivot point. This should allow the pendulum to swing a complete cycle every 2 seconds. The pendulum swing can be adjusted to make the clock run faster or slower by moving the Bob up to speed it up and down to make it run slower.

5 - All of the text and the numbers on the dials are intended to be engraved onto the wood and not cut all the way through it.

6 - Although some small clearance is given to the snap in parts it is intended that they be a tight fit. To ensure that happens on your set up it is advised that you do some test peices first to establish the settings for your machine, both for the snap fits and the fits for the shaft ends (nails) into the holes on the front and back planes.
On the Laser machine used for the prototype build the laser beam had a width of 0.3mm. For all the holes and the interal cutouts an inward correction of 0.1mm was applied. For all the important external forms that is those forms that mated with another part, an outward correction of 0.1 was applied. For all the other external forms no correction was applied.
NB! Remember to setup all the lettering on the dial and the identification marks on other parts as engraving rather than cutting.

7 - All of the small pins used as pivots or dowels to hold parts together are cut from panel pins (nails) 1.6mm dia (1/16”). Use Plyers or Side Cutters to cut the nails to size. The lengths are relatively unimprtant but the pivots are around 12mm long and those used as dowels are generally 8mm long. The longer pin for the pendulum pivot 45mm is also 1.6 mm diameter but you may have to find some brass or steel wire to use for this. I used a length of stainless steel welding rod.