



Antikythera Mechanism



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Summary

First Mechanical Computer. Replica of the ancient mechanism found in a shipwreck near Antikythera.

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Tags: [marvel](#) [mechanism](#) [mechanicalmarvel](#) [antikythera](#)

This is a replica of the ancient Antikythera Mechanism found in a shipwreck near Antikythera dating back to ~200a BC. It is based on a slightly modified arrangement of the Freeth & Jones model with significant inspiration of Wright's and Clickspring's replicas.



In its current form contains:

- a solar calendar (365 1/4 days) “date pointer”
- position and phase of the moon mapped relative to the ecliptic (zodiac) “moon pointer”
- position of the sun mapped on the ecliptic (zodiac) “true sun pointer”

For V1 I've omitted the entire rear face. The original included the metonic cycle (ancient 19 year/235 lunar month calendar) and the callippic cycle (76 year cycle extending the metonic cycle), the olympiad (4 year games cycle), the Saros cycle (predicts occurrence of solar and lunar eclipses in a 223 lunar month repeating cycle) and the Exeligmos cycle to compensate for the 8h offset created by each successive Saros cycle to accurately predict the time and position of potential eclipse occurrences.

For V2 I'll look into adding a rear panel. All gears required for that addition are already included (M2 and E4) and it should be a straightforward install to the rear.

BOM

mostly everything relies on a pressfit with cheap 608 bearings doing the bulk of the work here. Ensuring that the mechanism runs smooth and with little torque requirements.

- a ton of printed gears
- 3D printed frame, dial, legs and pointers.
- 21 608 skateboard ball bearings
- small handful M3x10 screw
- (optional) ideally 1 M3x16
- 2x M3 hex nut
- 15x M3x6 countersunk screws
- a bunch of M3 threaded inserts

Printing

the frame and big wheels are scaled to perfectly fit a Prusa MK3s+ bed (250x210mm) so your printbed needs to be of equal size or bigger.

- **0.4 nozzle, 0.45 extrusion width** (all walls designed to be at least three times of that)
- **0.2 layer height** (0.25 should not pose any significant issues)
- overhang friendly by design (unless K-Axle that needs supports)
- the frame and legs can be printed in 0.3mm draft mode
- axles and gears all have small triangular cutouts on the mating surface to hopefully get your slicer to place the seams there. double check for perfect friction fits.

for simplicities sake I assigned a different color to each “sub-mechanism”. This just helps visualize what's going on, track the path through the various concentric hollow axle and help with assembly.

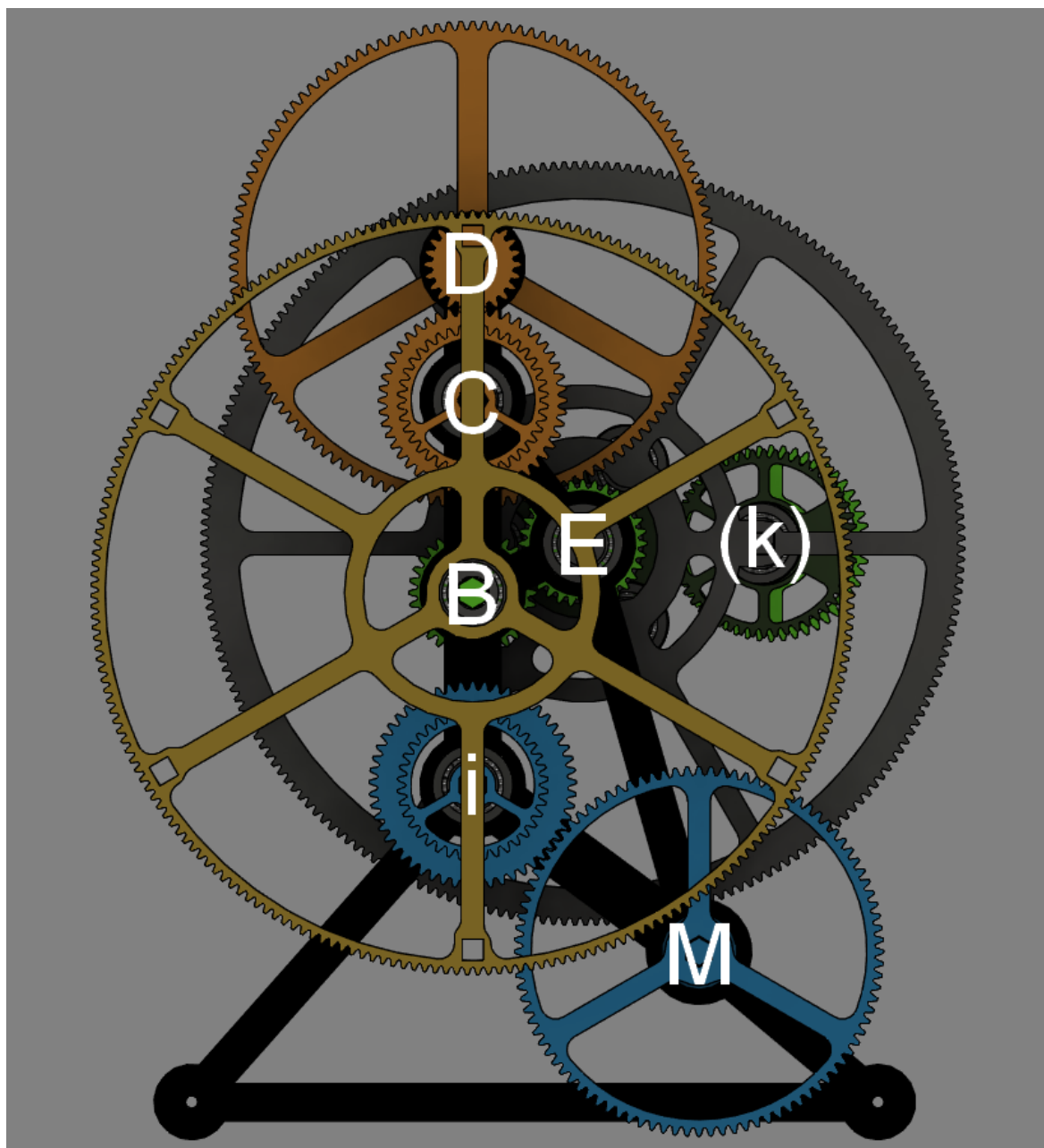
- orange for the date → sidereal moth conversion
- light green for the lunar synodic month of 29.53 days (NASA value 29.530589 days)
- dark green for the lunar sidereal month of 27.321 days (NASA value 27.321661 days)
- blue for the date → lunar orbit precession E3 gear in 8.8826 years (real 8,85 years)
- bronze for date and sun
- black for frame, legs and various other parts.
- grey/marble for the moon (black for the dark side)

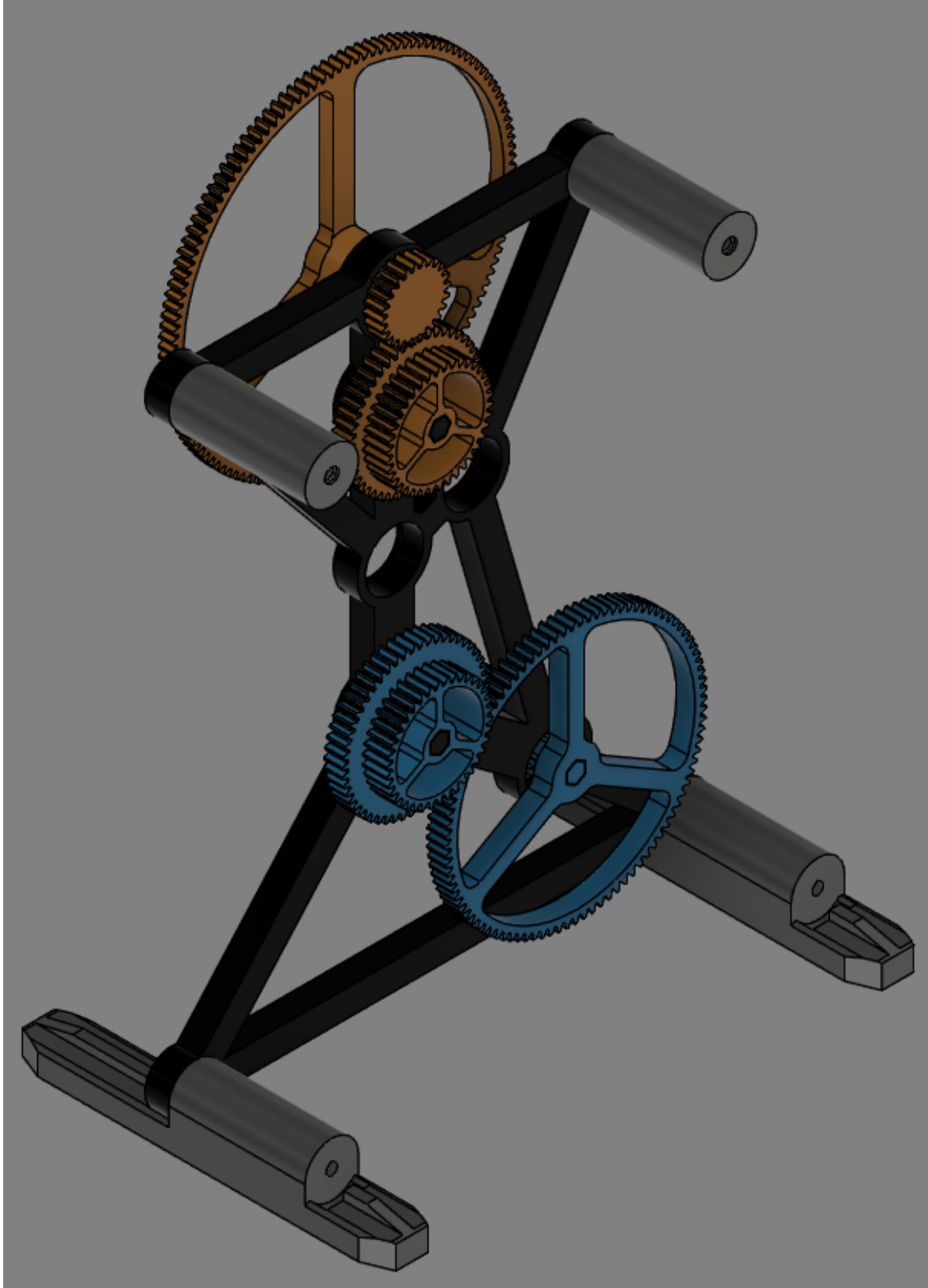
Actual filament used is:

- Prusament PLA Orange
- Prusament PLA Simply Green
- Prusament PLA Army Green
- Prusament PLA Azure Blue
- Prusament PLA Viva La Bronze
- Prusament PLA Galaxy Black
- Prusament PLA Marble Grey

Assembly

Assembly is straight forward, especially when color coordinated. The E-Axis and the mechanism around the true sun daughterwheel on B1-2 can be tricky.

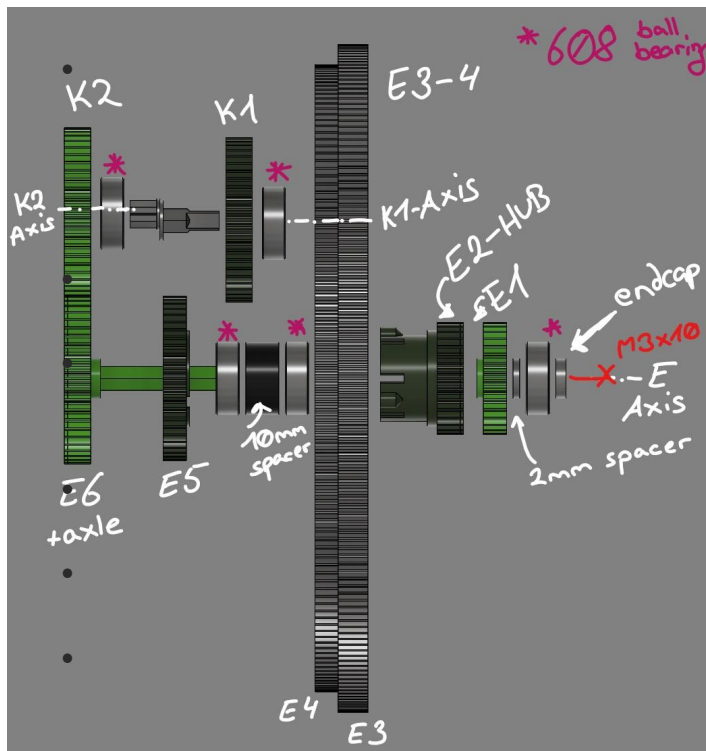




Step 1:

- press bearings into mainframe
- press axles into i1-2 and C1-2
- melt threaded inserts into legs and standoffs
- push all gears in their respective places as shown
- screw in feet using any M3 screws

TIP: usually the first pressfit is excellent but usually by the third mating cycle it's no longer tight enough. Just wrap the axle in one layer of tape (e.g. tesa cellutape)



Step 2: E Axis

press bearings into **K1** and **K2** as well as into **E2-hub** separated by a 10mm spacer and onto the 3 pegs on **E3-4**

slide E3-4 onto E2-hub and follow up with E5

(optional) lock E5 should the pressfit not suffice, M3x6 countersunk

slide E6 through the assembly

push E1 onto axle (of E6) from the other side

insert hexnut and screw in pin (ideally m3x16 but x10 works too)

align K1 above the square

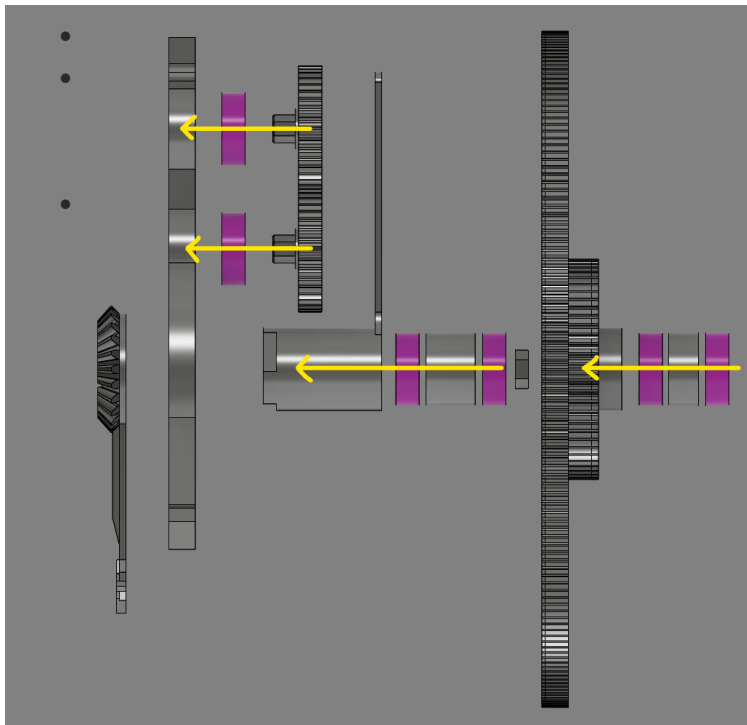
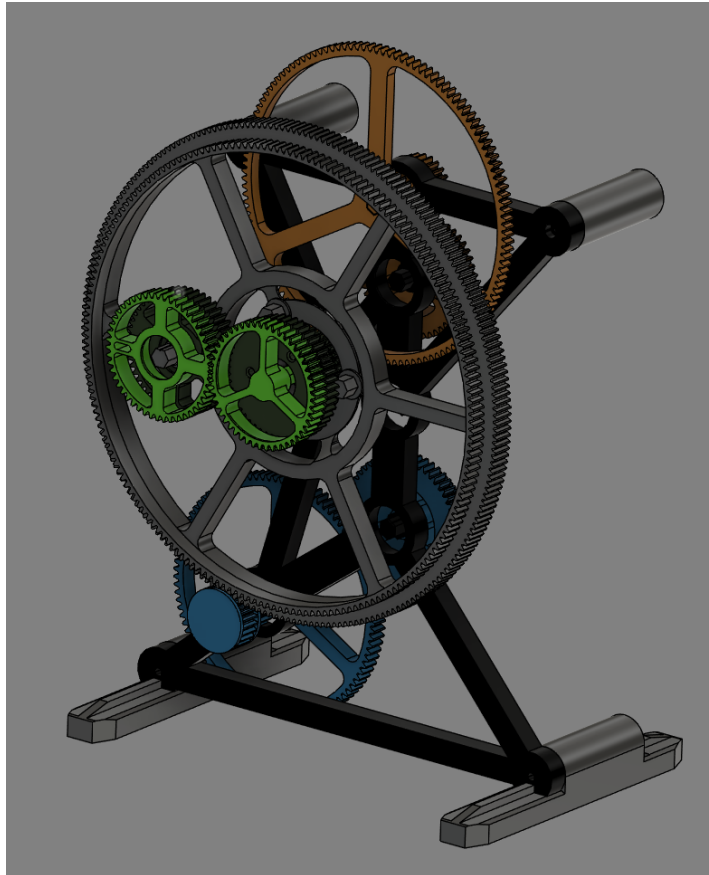
- hole
- insert K-axle through the K1 bearing into E3-4
- add 2mm spacer to axle
- add threaded insert into tip of B3-gear-axle part
- insert the long B3 gear and axle from the rear into the B-hole
- push axle into the E bearing in the mainframe and lock in place using the endcap and a M3x10

Both K1 and K2 are oriented in a way that their lip catching the bearing are facing the rear

It should now look something like this (B3 & B-axle missing here)

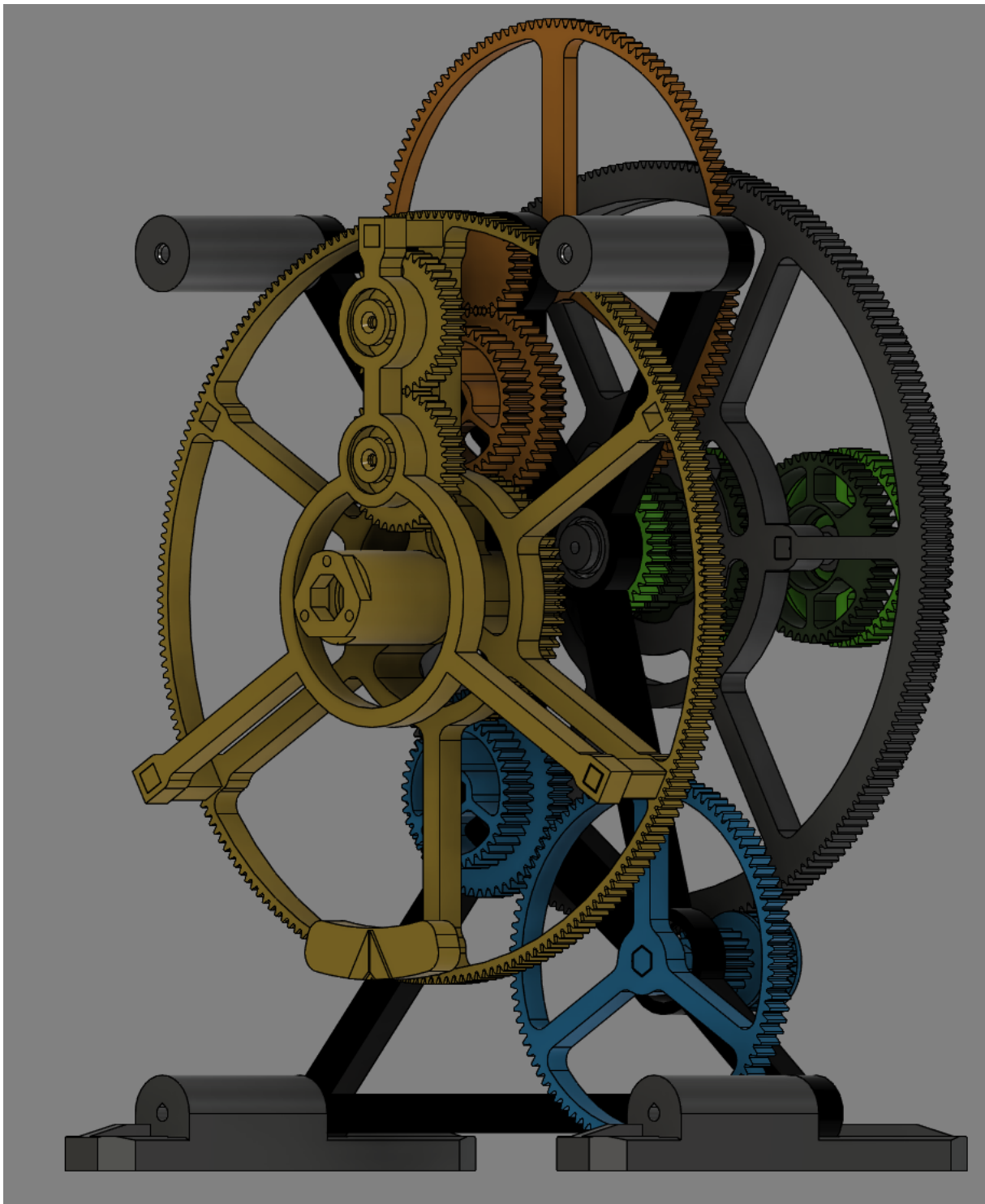
Next up: Assembly around the **date wheel B1-2**

- pressfit bearings (pink) into the wheel and subframe
- use spacers as shown
- add pin to sun3 (M3x10 and hexnut)
- pressfit sun gears 2-3 into subframe (sun3 being the outermost gear with the pin)
- add standoffs to subframe
- add 3mm spacer to B3 axle from the front
- push big B1-2 gear onto B-axle
-



add 4mm spacer
push on true sun slot
push subframe onto B1-2
pay attention to the pin/
slot
lastly don't forget about
the date pointer and its
standoff
(180° to the sun2-3
spoke)

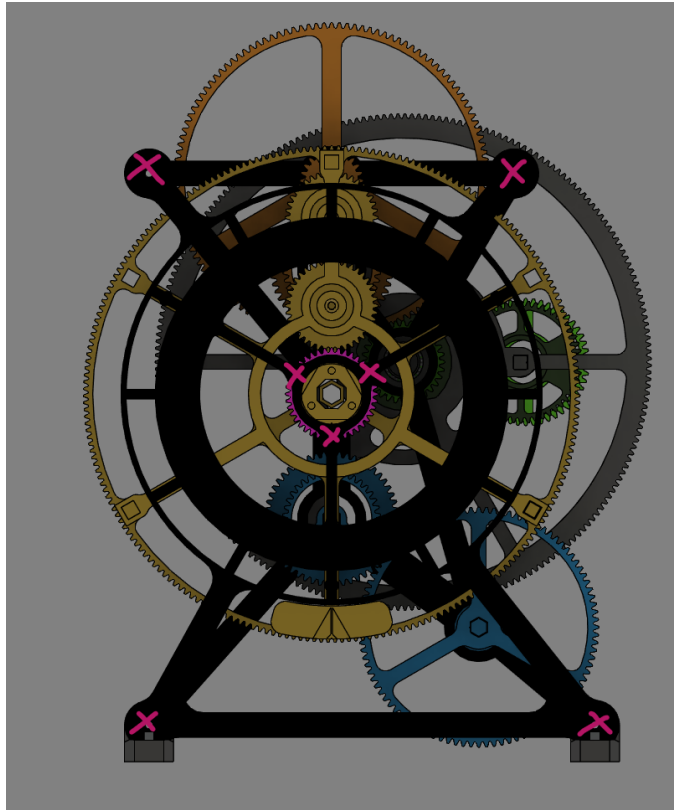
It should now look like
this (green B-axle not
pictured)

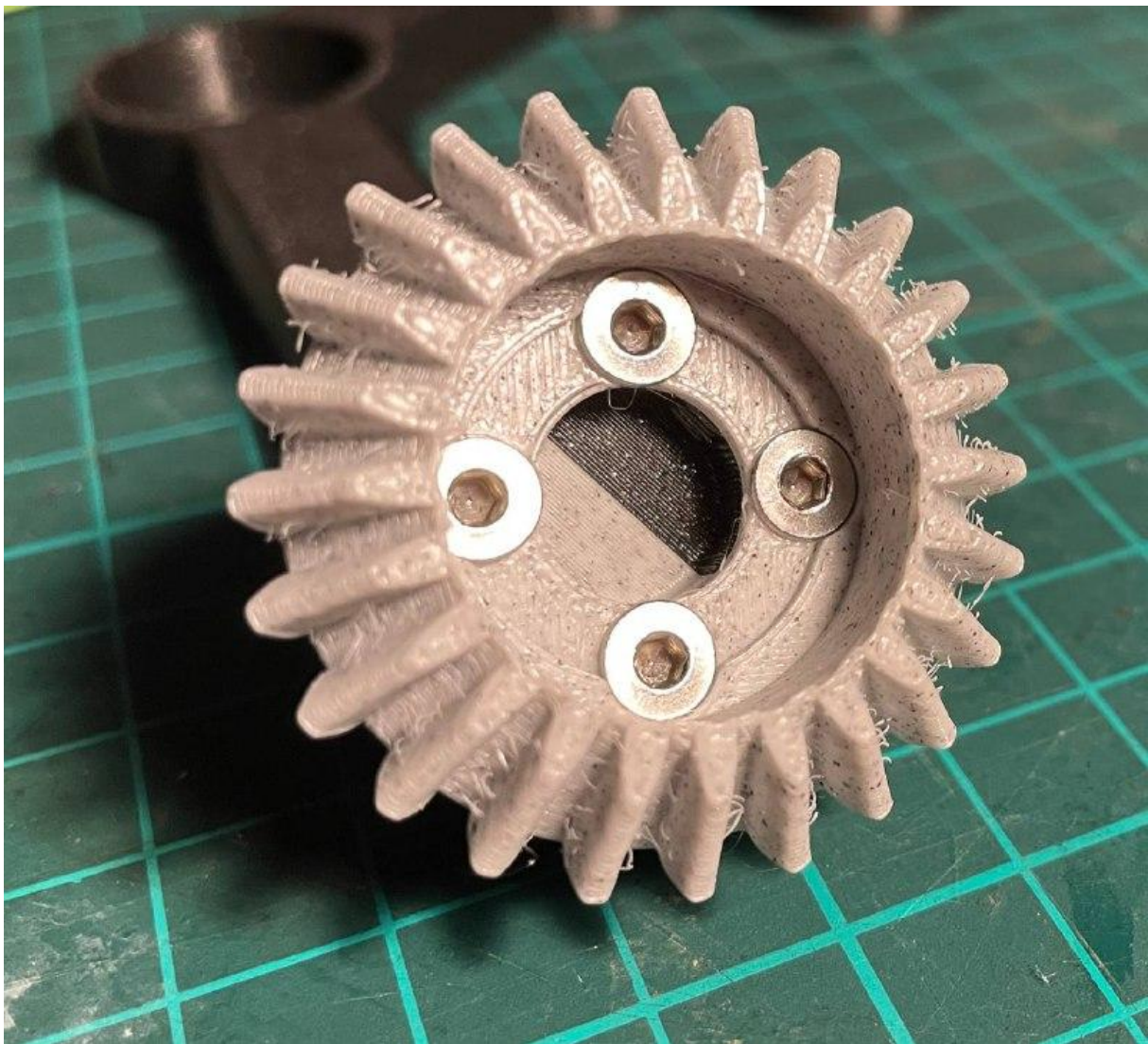
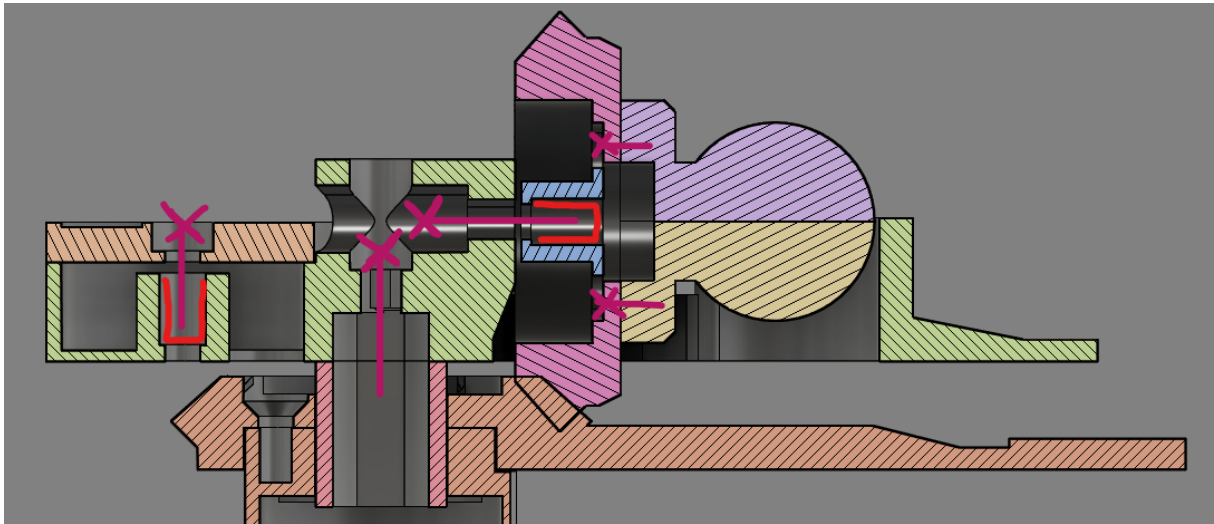


Next up: **front dial**

- slide the deep gear sun-1 on
- add the front dial
- screw in the frame using 4x M3 screws
- secure sun-1 using 3x M3x10 screws
- add true sun hand and secure using 3x M3x6 countersunk screws
! hand must face same direction as date pointer

Now the only thing thats left is
the Moon





- screw the bevel gear into the moon halves (M3x6 CS)
- push moon phase axle into bearing
- THEN insert threaded insert;
while you're at it insert one into the moon hand too;
(inserts shown in red above)

- place bevel gear assembly into moon hand and screw in using the horizontal M3x10 screw.
(current version is a bit tricky since the bearing spins but I have a hotfix coming for that)
- add a counterweight bearing to the moon hand
- add the moon cover
- push the moon spacer onto the main B-axle and add the moon assembly
- screw it down using the last M3x10 screw (not too tight)



Calibration

Guide to calibration is coming soon but in short you need to align the moons Perigee or Apogee with the correct date and moon phase. Perigee would be when the pin on K1 is on the inside end of the slot in K2. To calibrate you need to [pick a date here](#), disconnect B1-2 and K2 rotate the mechanism to the desired date and reinsert K2 in the correct position. The precession (E3) is linear so no calibration required here.

Thanks

This has been a massive project for me, been constantly on my mind basically since the contest has been announced. I've pulled plenty of all-nighters because I couldn't stop or there was just one more feature I wanted to implement... It has been a ton of fun and I'm extremely pleased with how it turned out and I hope you enjoy it as much as I did creating it ;)

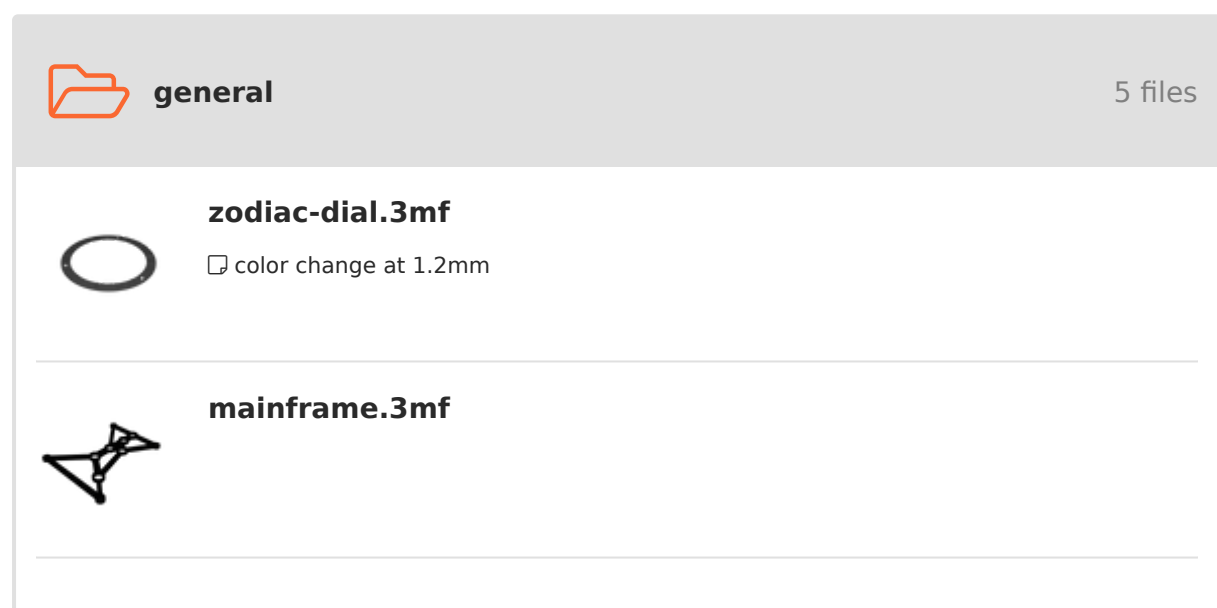
My biggest **Thanks** goes out to Mirnor who instantly came up with the idea when I told him I'm looking for a “mechanical marvel”. He helped immensely not only with research and math around the orbital periods but also kept me motivated throughout.

Future

- many more improvements in the pipeline
- I really gotta look into version management and automated exporting/sclicing
- rear face of the original machine even if somewhat out of context in this era
- inserts for the front dial (zodiac and date)
- crazy leap year mechanism ?
- wallmountable version
- add more retaining screws to axis to be less reliant on pressfits

For further clarification feel free to leave a comment!

Model files





front-plate.3mf



feet-51mm.3mf

☐ print twice



51mm-spacer-threaded-insert.3mf

☐ print twice or optionally 4x if you're skipping the feet e.g. wall mounting



Moon Hand

6 files



bright-side-of-the-moon.3mf

☐ face down optionally with variable layer height



dark-side-of-the-moon.3mf

☐ actually the same model as the other side of the moon



moon-cap.3mf



moon-spacer.3mf



moon-bevel-gear.3mf



moon-phase-axle-v2.3mf



blue M-Axis and i-Axis

4 files



m1-gear.3mf



i1-i2-gears.3mf

☐ requires a "i-or-C-axle"



i-or-c-axle.3mf

☐ 2x orange/blue or black



m2-m3-gears-and-axle.3mf



orange D-Axis and C-Axis

4 files



d1-gear-and-axle.3mf



c1-c2-gears.3mf



i-or-c-axle.3mf



d2-gear.3mf



b1-2 date gear assembly

15 files



sun-1-gear.3mf



true-sun-pointer.3mf



endcap-sun-wheels-x2.3mf

☐ print 2x



sun2.3mf



sun3.3mf



true-sun-daughterwheel.3mf



true-sun-pin-slot.3mf



true-sun-daughterweel-spacer-x3.3mf

☐ print 3x on flat side



date-pointer.3mf

☐ color change on the top layers to make the arrow stand out



date-pointer-spacer.3mf

☐ print on side, only 1x



b3-spacer-4mm.3mf

☐ space B1-2 and true sun pin-slot piece



b1-b2.3mf

☐ ~Viva La Bronze~



b1-2-spacer-9mm.3mf

☐ inside B1-2 to space bearings



b-spacer-3mm.3mf

☐ to space b1-b2-gear to the mainframe



b3-true-moon-gear.3mf

☐ still green because it represents the lunar synodic month



E moon assembly

11 files



e6-gear-with-axle.3mf



e5-gear.3mf



e3.3mf

☐ includes e4 188t



e2-hub.3mf



e-spacer-10mm.3mf



e-spacer-2mm.3mf



e1-gear.3mf



e-top-cap.3mf

☐ M3xWhatever into E6+Axle



k-axle.3mf



k2-gear-slot.3mf



k1-gear-pin.3mf

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