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Fisher Delta Geared extruder

Geared extruder for the 3D printer *Fisher Delta*

Entirely new design.

It does present the following advantages:

- Easy access to the tensioner adjustment
- Easy access to the hobbed insert for cleaning
- More powerful extruder allowing thicker layers
- Capable to unwind poorly wound spool (for me thats 2 spools on three tested !)
- With *spool on top*, the path is the most direct possible
- Bowden length reduced to 390mm, with more straight route.
- Reduced current (from 1200 to 1000) will make less heat for stepper and board drivers

and in addition:

- With a hole in the side panel, you can dye filament for extrusion calibration

as inconvenients :

- Retract speed is reduced - I use 80mm/sec
- You hear retraction due to play in gears (printing larger pinion ?)
- potential wear on gears, but as it is printed in PETG, the risk is low
- Bowden tongue more difficult to access, however you can see it from top

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Open the lever for cleaning



Instructions:

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GEARED EXTRUDER for the RepRapPro printer Fisher Delta
Use the specific M3 hobbed insert of RepRapPro (for Ormerod and other printers) but not the original hobbed insert of the Fisher.
Spring is the one of the Fisher extruder: external diameter 6.5mm, wire 0.8mm, length 7.5 mm
This extruder is specifically designed to fit in the tight space of the fisher (in the fisher the extruder is inside the printer, between the arms), but could be used for any printer with 'Bowden' hotend
A template to position the extruder is supplied. Be careful, the play between arms and motor with all carriages at top is less than 2mm (but your carriage are not supposed to go banging the supports, no ?)
The connection of the bowden is done with the specific RepRapPro 5mm brass insert. If needed, you could thread for

another connection.

This is mechanics, so your machine shall be well calibrated ans shall produce accurate dimensions. Gears (especially the pinion), shall be printed relatively slowly (50mm/sec) to produce more accurate teeth profile. Layer 0.2 for the gears. layers 0.2 or 0.25 for base and lever.
Printed in PETG on the Fisher, I really don't recommend to print it in PLA, that may be delicate to assemble without broke anything and there will be problem with the stepper temperature. ABS may be usable (but cannot be printed on a standard Fisher).
Recommended PETG yet: Reprapper. eSun PETG is NOT recommended (unworkable without this geared extruder due to poor winding, so egg and chicken problem here).
Do NOT Forget to activate support in your slicer for the base part. I forget it once for the prototype, then again for the final version (...)
It is an entirely original design, however the gears of the Ormerod extruder were reused (and slightly enlarged) and I get the idea to have the filament in the pressure lever from Ryan Carlyle *B'Struder*.
Driven by default RepRapPro stepper 2.2 kg.cm. More powerful motor may need enlarged gears.

BOM

Fittings

- 1 M3x30 Hex head screw for the hobbed drive
- 3 M3x35 countersunk screws for the stepper assembly on panel (thk 3mm)
- 2 M3x20 countersunk screws for lever articulation and push bearing
- 2 M3x40 screws (hex or cap head) for tensioner
- 1 M3x10 set screw for the pinion
- ordinary M3 nuts (lock is done with glue/resin)
- 1 medium size washer (large gear)
- 6 small sizes washer (4 for large gear and 2 for bearing)
- 3 bearings 623 (10x3x5)
- nut locking glue
- 1 M3 RepRapPro hobbed insert (dia 8) (only sold by them)
- 1 spring diam ext 6.5mm, wire 0.8mm, len 7.5 mm (salvaged from Fisher extruder)
- Shelf support 100x150 for spool on top
- O-ring for spigot spool 'brake'.

Printed parts (see files and program below):

- Base. Layer 0.2 or 0.25 mm
- Lever. Layer 0.2 or 0.25 mm
- Large gear. Layer 0.2mm, 50mm/sec
- Pinion. Layer 0.2mm, 50mm/sec
- Lever pushing pad. layer 0.2 mm
- Template/screw holder for panel fixation. Layer 0.2 or 0.25 mm
- Tongue for Bowden brass end (original could be reused).

For spool on top you also need to print:
- Spigot (80 or 100 mm length)

STL files supplied with holes 0.15mm larger in diameter than required (also apply for ractangular holes). Beware of your slicer settings, to not enlarge twice.

Files

Attach:Extruder_OpenScad.zip
Attach:Extruder_stl.zip Includes all stl and configuration file.

Assembly:

Tensioner nuts


Tip: if it is more difficult on one side to introduce the nut, push the nut all trough from other side (use a vise and screw).

Gear bearing

That shall be a reasonable tight fit.




Lever assembly

- countersunk screw M3x20
- M3 nut
- Two M3 small washers

Don't forget the washers.

Tip: gluing the washers to the bearing may help. You shall be very sparse with the glue, use a pin for glue deposit.




Test lever installation then remove it

removing the lever at the end will ease next steps.

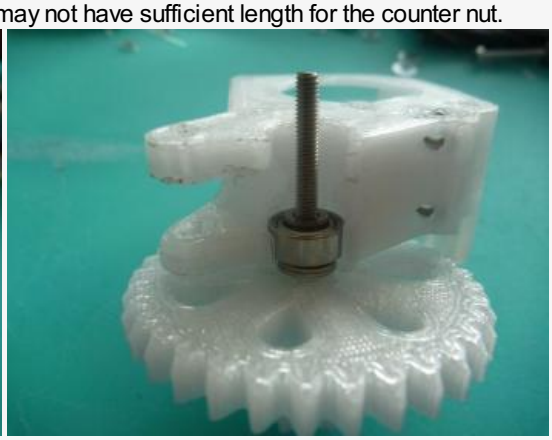


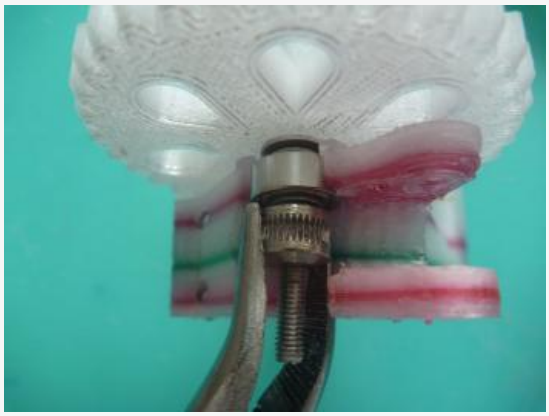

Seat hexagonal head screw in main gear, then remove nut

Be careful to not bend the bolt (I have done that with a non drilled socket spanner), so use preferably a flat spanner.
The example shows a stainless steel screw, but class 8.8 screw may be a better choice.
Tighten as firmly as possible without destroying the screw.


Hobbed drive assembly

The main gear may have some friction on the bearing support. If moderate, this is ok. Else, you may cut slightly the bearing stop with a sharp cutter. Do not add a washer, you may not have sufficient length for the counter nut.



Tighten as firmly as possible the hobbed insert, with care not to damage the hobbed part. Beware, false movement could break the support (I broke one...).


Do not glue the hobbed insert, it will make the ensemble impossible to disassemble. Only glue the counter-nut.

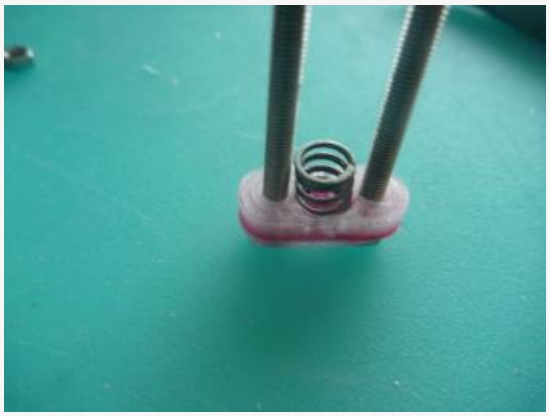
Lever final assembly - don't tight

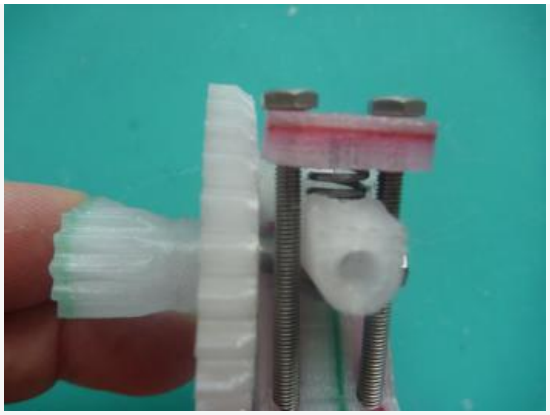
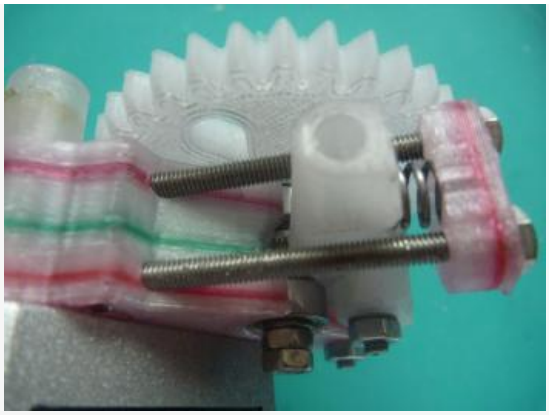
The nut is locked by the glue, not by tightening!
It shall be free moving, some friction is acceptable



Installation on motor


Tensioner assembly


Gear assembly




Panels and top hole enlargment

You need to make room in the panels for :

- The thumbweel - a few mm shall be removed on top left(less than on photo, this was for tests)
- Access to the top lever on top plate. There is significant clearance needed to be able to fully open the lever.
- Hole for filament inlet (diam 5mm)
- Hole on side panel to dye filament for extrusion calibration.: 20mm diameter, on the photo it is 14mm, too small for a marker.

Panel bolt testing and assembly

The printed part in the file contains a template for positioning accurately the extruder.
After drilling, cut the template part and use only the motor screw head support.
Beware, there is only 2mm play with the arms when carriages are at top.



Tongue set


Shorten your Bowden to 390mm. As for first setup, beware not introducing PTFE chips in the bowden tube. 2.4 or 2.5 mm drill (see Fisher assembly manual).

Tips :

- 3.2, 2.8mm and 2.4mm drill bits could be found in Dremel bit sets. This is useful for 3D printer assembly.
- For holes which need preparation, use bits rotating in reverse to not cut the material. It works well on PETG, but it melt PLA.