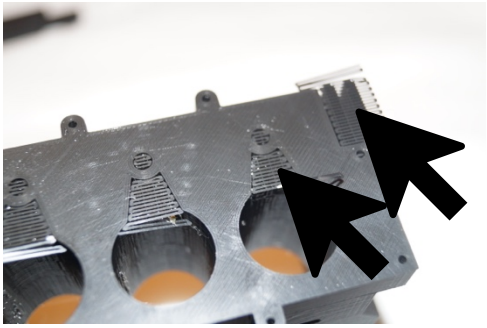
Let's Build Your Engine

Assembly Instructions

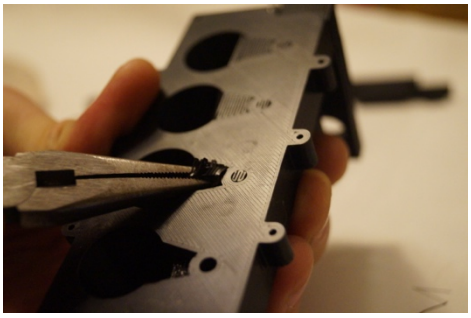
Now it's time to put all of your parts together!

STEP 1

Look at your pieces and clean them up. You need to remove any support structures, especially on the Engine Block. With some pliers and your finger, pull off this excess material that was needed to 3D print the piece but shouldn't be on the final structure.



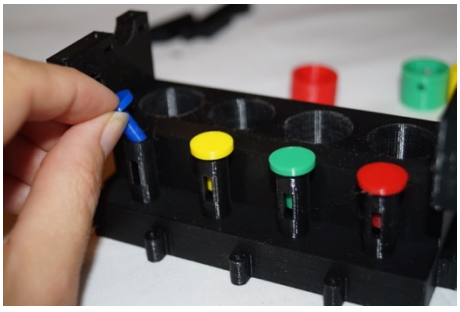
Also, look to make sure all of your holes are clear and are not blocked by any remnants of the filament. Use a small screwdriver or other small pointed object to clear any holes.



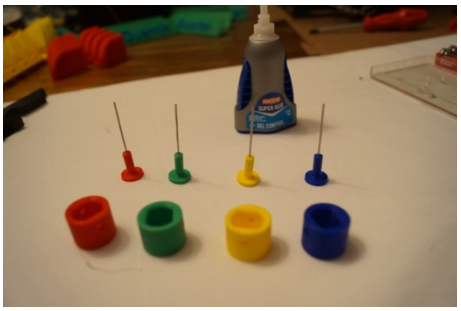
STEP 2

4 Lifters, Engine Block

Make sure that your 4 lifters fit into their holes with as little friction as possible. Sand the lifters and/or holes if you notice any sticking.

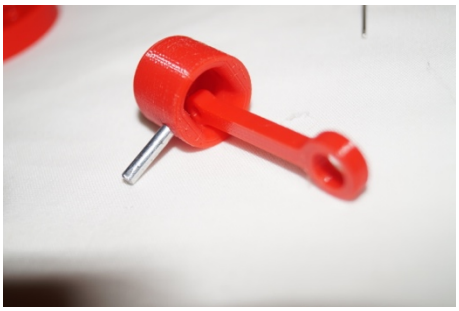


STEP 3



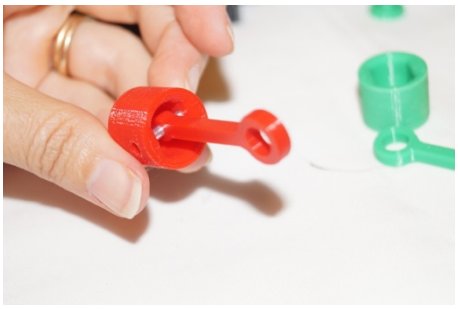
4 1-mm Rods, 4 Lifters, Glue
Take four 1-mm rods and stick them into the holes on the lifters. Apply a small dot of glue to the end of the rod before inserting to insure a good fit.

STEP 4



4 Pistons, 4 3-mm Rods, 4 Connecting Rods
Sand each of your Pistons to be sure they are smooth and round. Then insert a 3-mm rod through the hole on the Piston, then through the Connecting Rod, and then through the hole on the other side of the Piston.

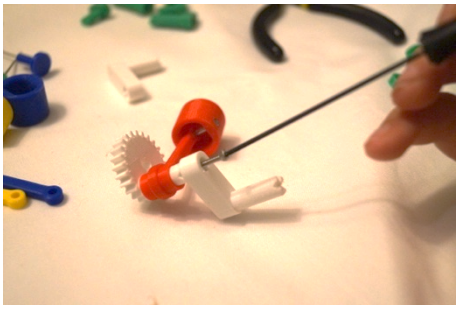
Repeat for each of the 4 Pistons.



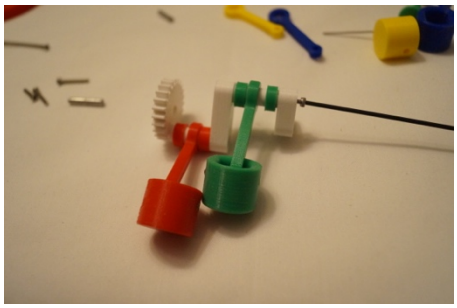
STEP 5

Crank Gear, 2 Crank Spacers, Piston/Connecting Rod #1, Crank Throw, 22-mm Bolt
Take a Crank Gear, add a Crank Spacer onto the shaft. Then slide the Connecting Rod (the end with the large hole, the other side is attached to the Piston) onto the shaft. Then add another Crank Spacer.

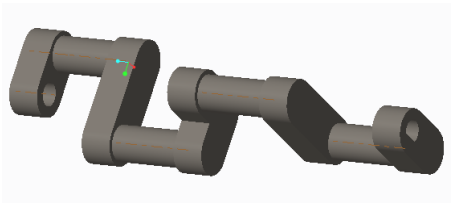
Position a Crank Throw piece on to the Crank Gear (the two ends with “locks”). Align them so that the Crank Throw comes back across the center of the Crank Gear. Put a 22-mm bolt through the Crank Throw into the Crank Gear.



STEP 6

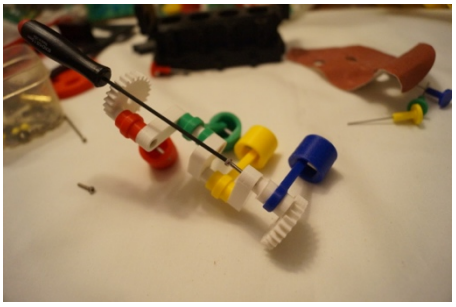


2 Crank Spacers, Piston/Connecting Rod #2, Crank Elbow, 22-mm Bolt
Now add a Crank Spacer, the Connecting Rod for Piston #2, and another Crank Spacer on to the Crank Throw. Then position the Crank Elbow piece. The bend in the Crank Elbow should be in line with the center of the Crank Gear. Use a 22-mm bolt to join the Crank Elbow to the Crank Spacer.



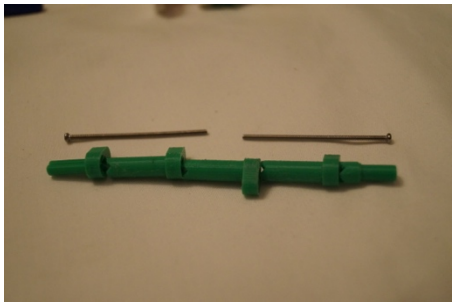
This drawing shows how the Crank pieces should be aligned, if you removed the gears and the Connecting Rods.

STEP 7



4 Crank Spacers, Pistons/Connecting Rods #3 & #4, Crank Gear, Crank Throw, 22-mm Bolt
Repeat Steps 5 and 6 in the opposite order to join the other 2 Connecting Rod/Pistons. There should be a Crank on each end and 4 Pistons.

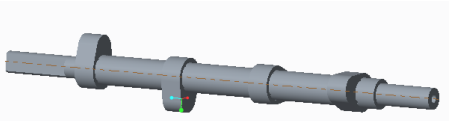
STEP 8



Cam End, 3 Cam Middles, Cam Drive, 2 50-mm Bolts
Next, we will put the Cam shaft together. Start with the Cam End. Attach a Cam Middle using a 50-mm bolt.

Now attach another Cam Middle piece with the lobe in the opposite direction of the one you just put on.

Now take the Cam Drive and attach the third Cam Middle to it using another 50-mm bolt, making sure that the lobe of the Cam Middle is facing in the opposite direction from the one on the Cam Drive.



Finally, take the two halves and attach them with the two middle lobes 90 degrees off from each other. Lay the rod in front of you and make sure that the lobes are facing UP, DOWN, LEFT, RIGHT when you look at them from left to right.

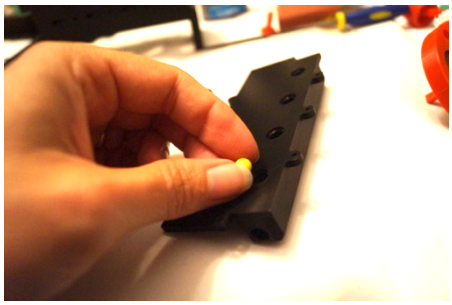
STEP 9

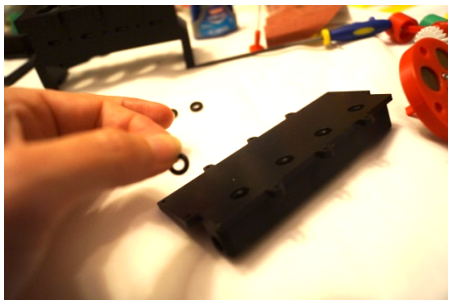
Flywheel, Flywheel Hub, 8 Pennies, 2 12-mm Bolts
Press your pennies into your flywheel holes, 2 in each hole. Bolt the Flywheel to the Flywheel Hub using 12-mm bolts.

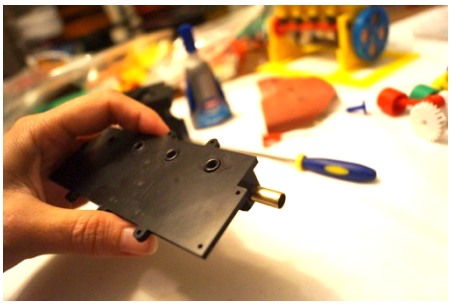
STEP 10

4 BBs, 4 O-Rings, 1” Brass Tube, Cylinder Head
Put one BB into each of the holes on the Cylinder Head. Put an O-Ring into each of the divots on top of the Cylinder Head.

Push the 1” Brass Tube into the inlet hole on the Cylinder Head.

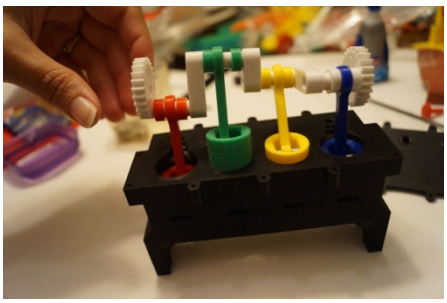






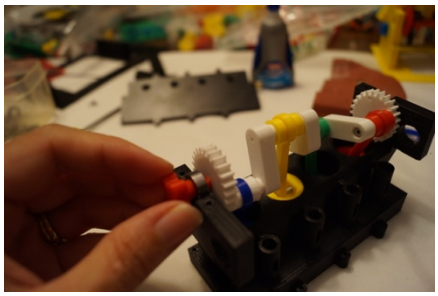
STEP 11

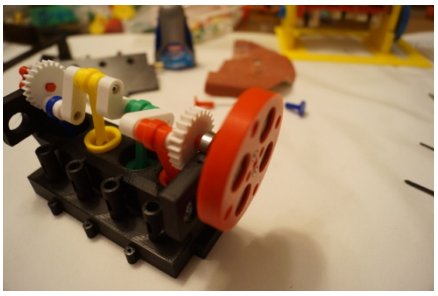
Assembled Crankshaft, Engine Block
Take the Crankshaft with the Pistons (the Rotating Assembly) and place it in the Engine Block. Make sure that the Pistons are in their corresponding cylinders.



STEP 12

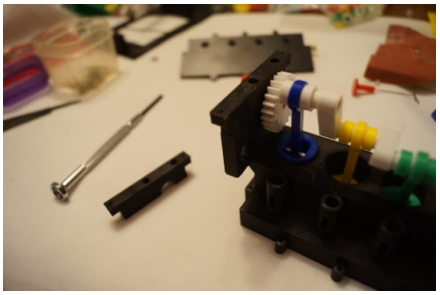
2 Bearings, Flywheel Hub, Flywheel Assembly
Add a Bearing to the shaft of both Flywheel Hubs (one should already be attached to the Flywheel). Put the Flywheel Hub on one side of the Engine Block and the Flywheel with its attached Hub on the other side. It does not matter which side.

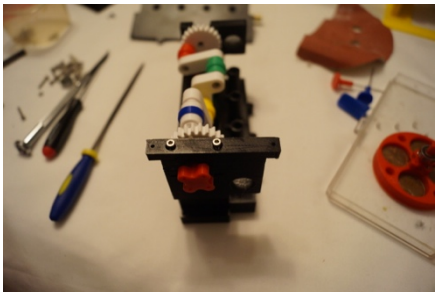




STEP 13

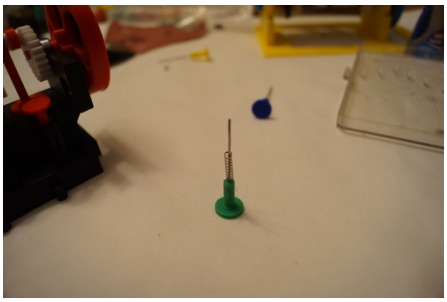
Main Caps, 4 12-mm Bolts, 4 Nuts
Take the Main Caps and put them on each side so they secure the bearing in place. Attach with 12-mm bolts and an optional nut in the slot in the engine block.

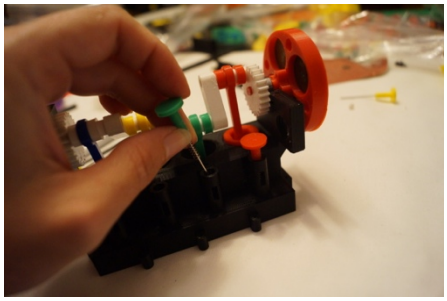




STEP 14

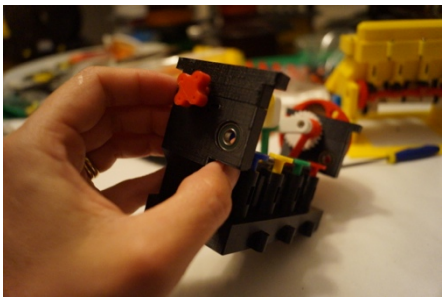
4 Springs, 4 Lifters
Put a spring onto each lifter. Slide the lifter into its corresponding hole.



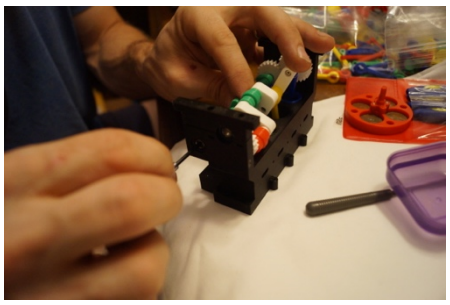


STEP 15

Assembled Cam Shaft, 2 Bearings
Slide the cam into place by putting the Cam End through the hole for its bearing, then bringing the Cam Gear into contact with the Crank Gear.



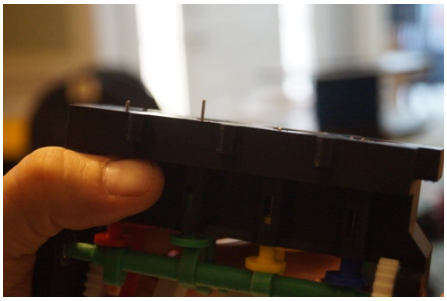
Align the timing marks on the Cam Gear and Crank Gear. If you do not see a small indentation on the Cam Gear, it might need to be flipped around. The marks should align such that the valley of one gear aligns with the peak of the other.

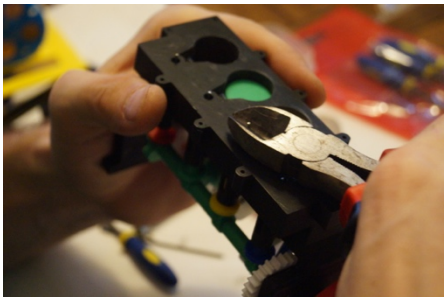


Disassemble and reassemble the Cam Shaft so that you can attach it.

STEP 16

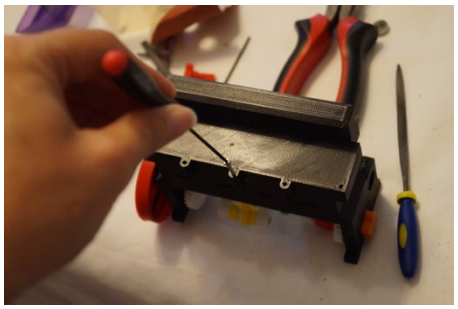
Now we need to adjust the length of the little rods extending from the Pistons. Turn your shafts so that one of your Piston rods is at its lowest point. Cut it off so that it is level with the Engine Block. Repeat this for the remaining 3 piston rods.





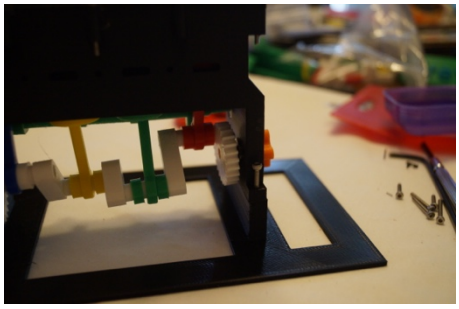
STEP 17

Cylinder Head, Engine Block Assembly, 10 Bolts
Attach the cylinder head using bolts.



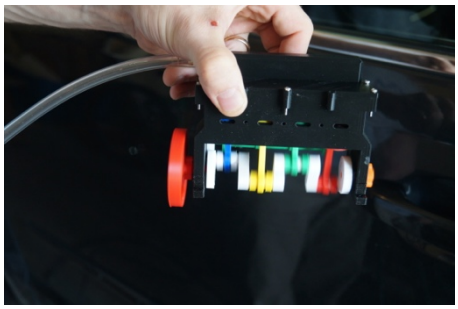
STEP 18

Engine Stand, Engine Block Assembly, 4 Bolts
Attach the Engine Stand to the assembled Engine Block using 4 bolts.



STEP 19

Check to see if your Engine works by blowing air into it. If you have good lungs, you might be able to this by mouth. Otherwise, use an air compressor. Make the adjustments necessary (such as sanding any pieces that seem to stick) to make sure your Engine runs smoothly.



Now you have a working 3-D Printed Combustion Engine!