Let's Build a Can Stirling Engine

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Step 1 - Material Preparation and Structure

To make the Can Stirling engine you require these materials: wood board 10mm thick; balsa wood 10mm thick; wire 1.5mm diameter; fishing thread; a balloon; square lumber 5mm square; two thumbtacks; a paper clip; clay; a 200ml steel can; cardboard; a candle; nails (or wood screws); and rubber bands.

These tools are required: cutting pliers; scissors: a saw: wood glue: some quick-drying glue: and machine oil.

This engine has a very simple structure as Figure 1. It makes use of wood frames, a wire crank shaft, a can cylinder, a rubber balloon diaphragm. You can get these materials easily. The wood piston is connected to the crankshaft with fishing thread.

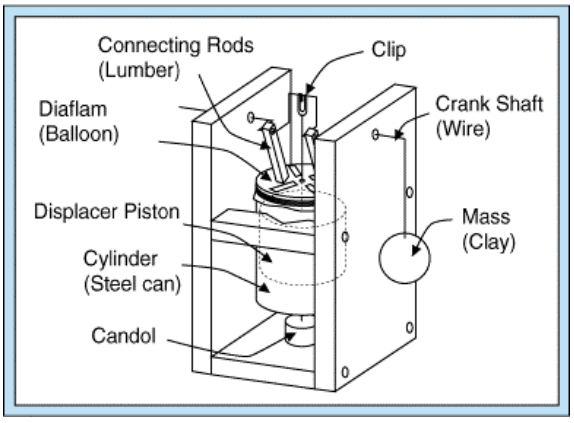

Fig. 1 View of a Can Stirling Engine

Step 2 - Cut a Wood Board

As illustrated in Figure 2, you must make two side boards, two boards to fix to the can, and a bottom board, all of 10mm thickness.

You must make the holes for the crank somewhat bigger to reduce friction

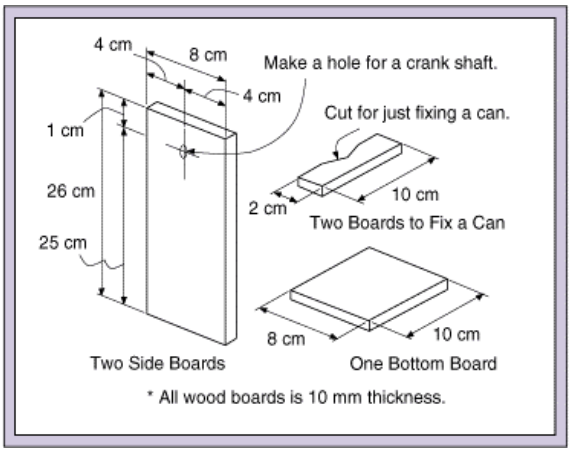

Fig. 2 Cut a Wood Board

Step 3 - Make a Wood Piston

Fit the pieces of cut balsa together with wood glue. Attach a length of fishing line to the center of the piston with quick-drying glue.

The diameter of the can which I used is about 50mm. The height of the can is about 100mm. If you use an other-sized can the diameter and the height of the wood piston must be fitted to the can. Clearance should be 2 or 3mm.

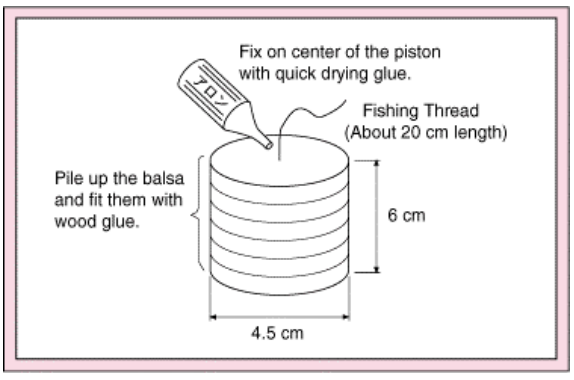

Fig. 3 Make a Wood Piston

Step 4 - Make a Diaphragm

You will make a diaphragm using a rubber balloon. As shown in the Figure 4, cut the balloon and reinforce it by pasting the card boards. Make a

hole in the center of the diaphragm and pass through a fishing thread. Be careful to make a close-fitting hole - not a big hole.

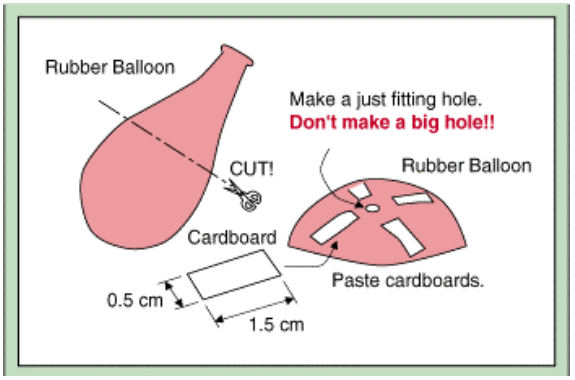

Fig. 4 Make a Diaphragm

Step 5 - Make Connecting Rods and a Crank Shaft

As illustrated in Figure 5, make two connecting rods using lumber that is 5 mm square. Make the holes for the crank shaft somewhat bigger to reduce friction. Bend a wire of 1.5 mm. diameter. Put on the connecting rods before bending the wire.

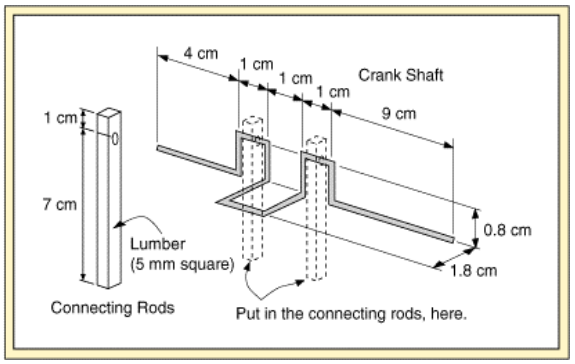

Fig. 5 Connecting Rods and Crank Shaft

Step 6 - Construct a Diaphragm and Crank Mechanism

As illustrated in Figure 6, attach the diaphragm and the connecting rods with two thumbtacks.

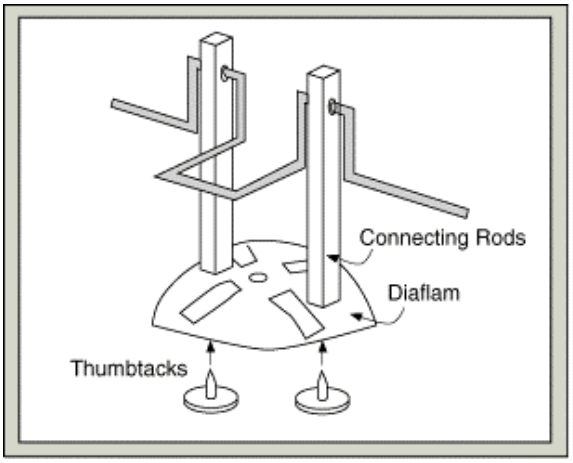

Fig. 6 Construct a Diaphragm and Crank Mechanism

Step 7 - Construct the Frame

You will construct the wood frame (See the Step 2). When you construct the frame, you must make sure that the crank shaft can rotate with a very small friction loss.

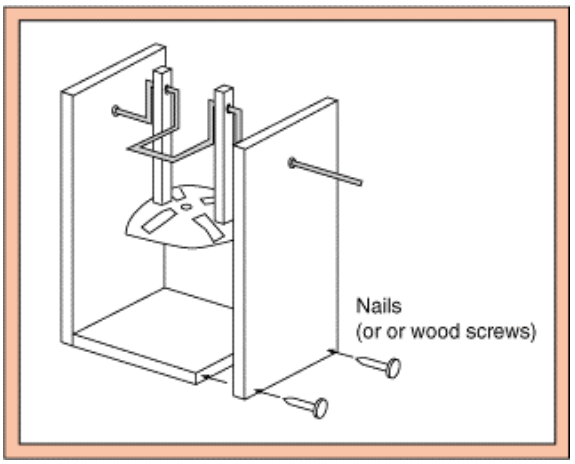

Fig. 7 Construct the Frame

Step 8 - Construct a Wood Piston and Crank Mechanism

After you pass the fishing thread through the hole in the diaphragm, You must tie the thread to a paper clip attached to the crankshaft.

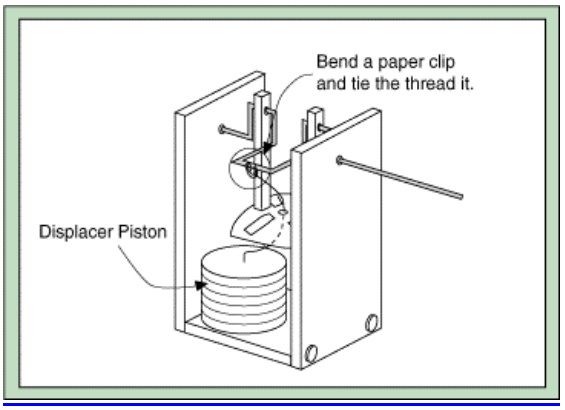

Fig. 8 Construct a Wood Piston and Crank Mechanism

Step 9 - Fit Up a Can

Cut off the top face of a can and fix the can to the frame securely. Place the diaphragm over the can with some rubber bands. Adjust a length of the fishing thread so the piston moves without touching the can. And for the final measure, put on a drop of machine oil in the hole of the diaphragm. The Can Stirling Engine is completed.

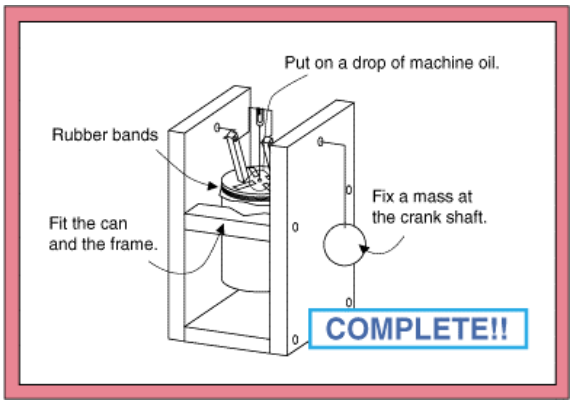

Fig. 9 Fit Up a Can

Step 10 - Let's Try to Move

When the engine is completed, Please heat a bottom face of the can cylinder with a candle. When the face is fully heated, rotate the crank shaft with your hand. Does the engine start to move?

There are two important points to move model Stirling engines. One is a perfect seal of the air in the engine. Another is low friction of the mechanical parts. If your engine does not move, check these points. Does the air leak from the hole of the diaphragm? Does the wood piston touch the cylinder?

FAQ

Q1: Do I have to stretch the balloon or do I have to make it little bit loose?
A1: You must stretch the balloon somewhat as a face of the balloon becomes flat.

Q2: Can't I use the fishing thread to make the hole in the balloon, so that it is air tight?
A2: I use a needle to make the hole. And I can get a few air leakage when the machine oil was dropped.

Q3: My steel can is 13 cm height and the piston is only 6cm height, does this have any negative effect?
A3: It is no good. When you use the 13 cm steel can, you must set the piston height to 9cm. It is important that the dead volume in the engine is decreased.

Q4: I used a cylinder with diameter of 66 mm and 100 mm height. This will cause any problem?
A4: Your cylinder does not cause any problem. Please make sure that the wood piston does not contact to the cylinder, and keep the clearance between the wood piston and the cylinder to about 3~5 mm.

Q5: I built the Can Stirling engine. But it cannot work. Please tell me how to work it.
A5: You must decrease the gas leakage and the friction loss of the Can Stirling engine. Please make sure following points.
(1) Is the hole of the balloon too big?
(2) Have you putting on a drop of oil to the hole?
(3) Can the crank shaft work smoothly?
(4) Are holes of the frame and the connecting rods too small?
(5) Does not the mass weight touch the frame?
(6) Does not the wood piston contact to the cylinder?
(7) Please adjust the weight of the clay in detail.

Q6: How many engine speeds can the Can Stirling Engine get?
A6: This engine gets about 100 rpm. When the mechanical loss is decreased with your original idea, you can get more high speed.

Q7: How many grams is the clay mass in the Can Stirling engine?
A7: The clay mass is about 50 to 100 grams, maybe. But you must adjust it suitably after you complete to built the engine. I think that you will be able to find the suitable grams easily.