PAPER MODEL OF A FOUR-STROKE ENGINE

Target age group: grades 5-12

Materials needed: Copies of the two pattern pages printed onto white card stock, scissors, white glue, clear tape, 3/4-inch paper fasteners (2 per person), colored pencils in these colors: red, yellow or orange, and light blue.

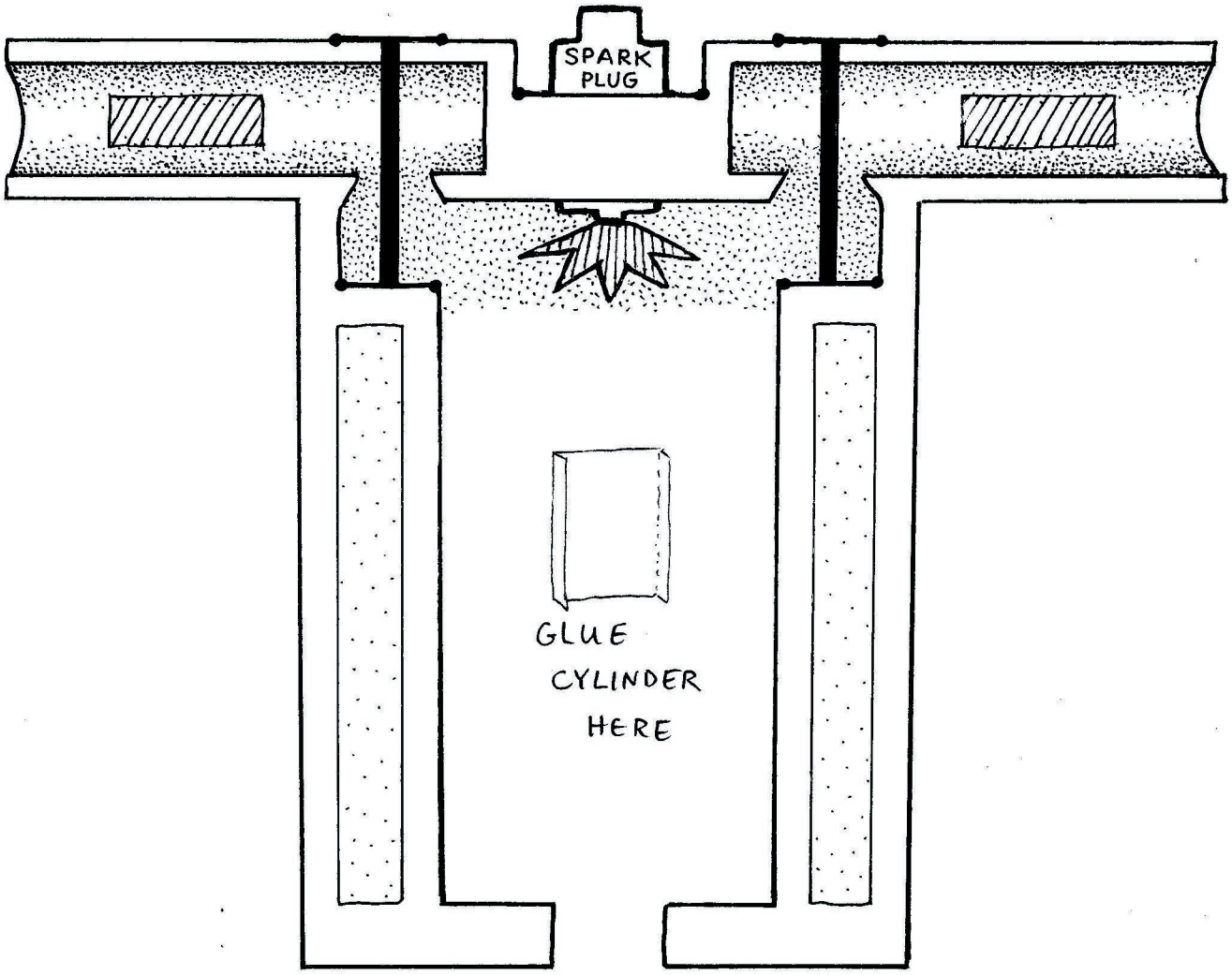
Time allowance for working with a group of more than 10 students: 35-40 minutes with grades 5-8, and 25-30 minutes with high school (If you have a smaller group you may need less time.)

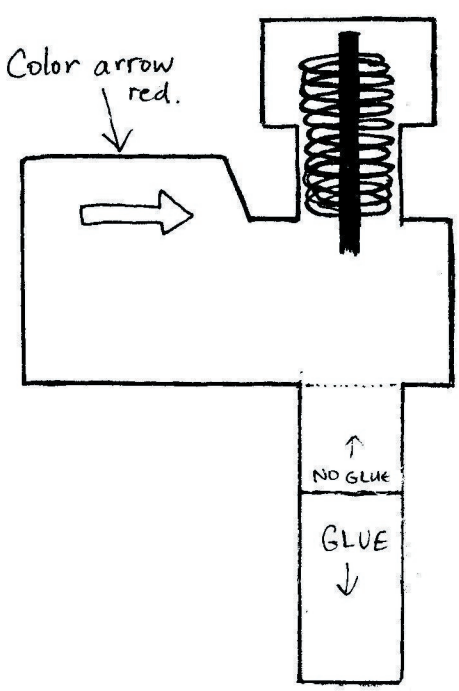
Directions:

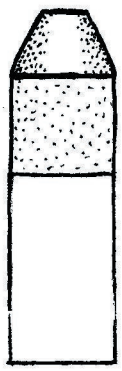
Make copies of the two patterns pages on white index card stock. Print out copies of the instruction sheets on regular paper. (Two students could share a copy.) Assemble the engine according to the instructions on these sheets.

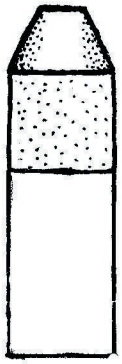
THE FOUR-STROKE ENGINE

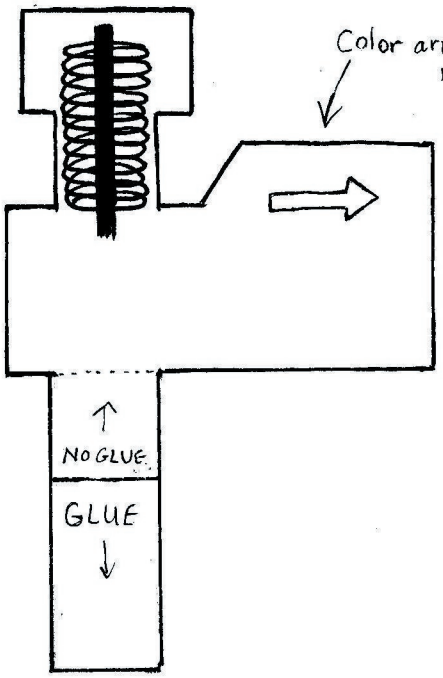
STROKE 1: Open IN valve to let fuel/air mixture in. Make the piston go down. Close IN valve.
STROKE 2: Make the piston go up to compress the fuel/air mixture.
STROKE 3: Fire the spark plug, then move the piston down again.
STROKE 4: Open OUT valve to let out exhaust. Move the piston back up. Close OUT valve.

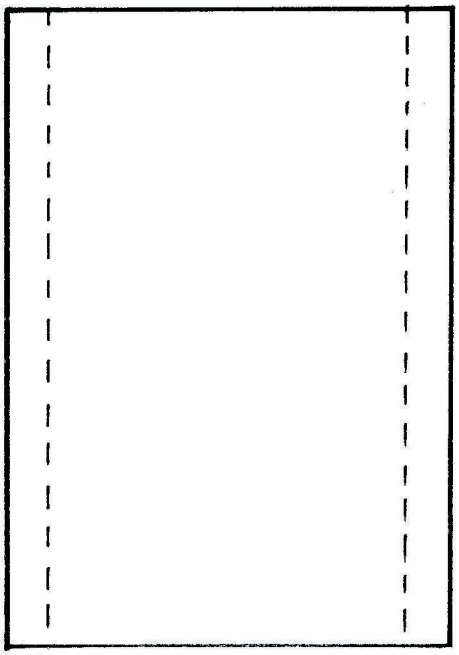


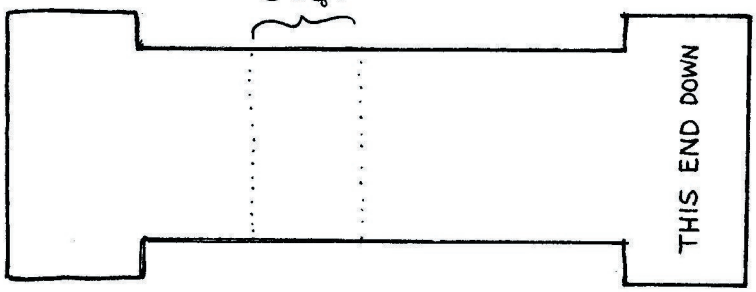

Color arrow red.
NO GLUE
GLUE

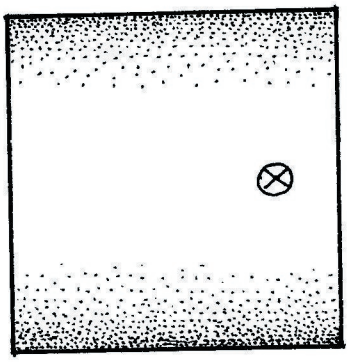


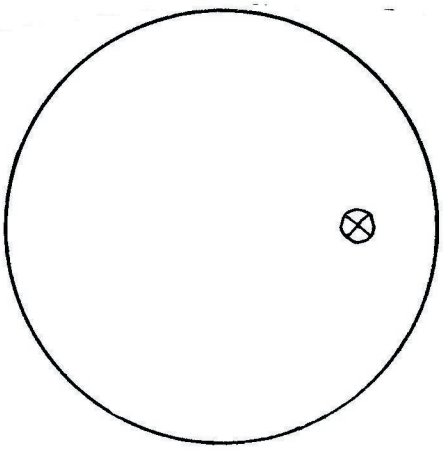


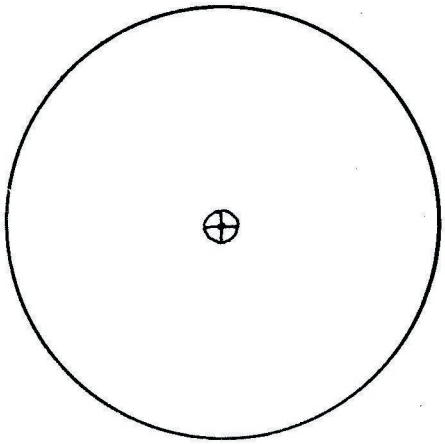

Color arrow red.
NO GLUE
GLUE




Color this section (between dotted lines) bright orange or red.
THIS END DOWN







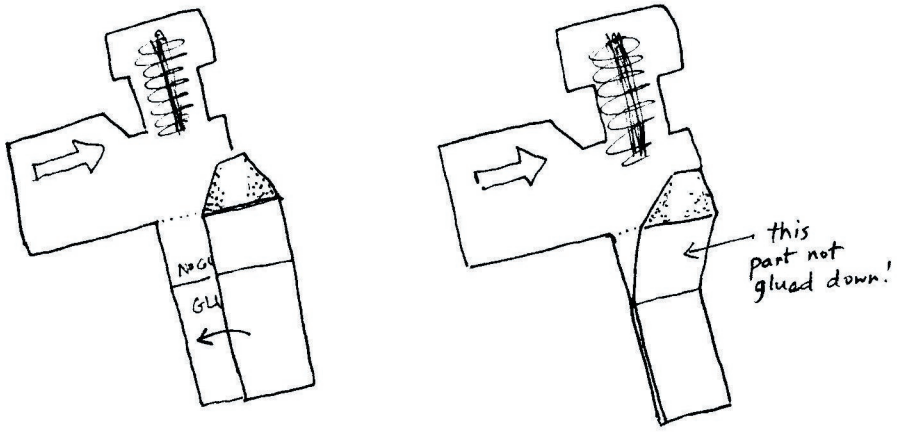
HOW TO ASSEMBLE THE 4-STROKE ENGINE MODEL:

First, copy parts + engine page onto white card stock (heavy weight paper)

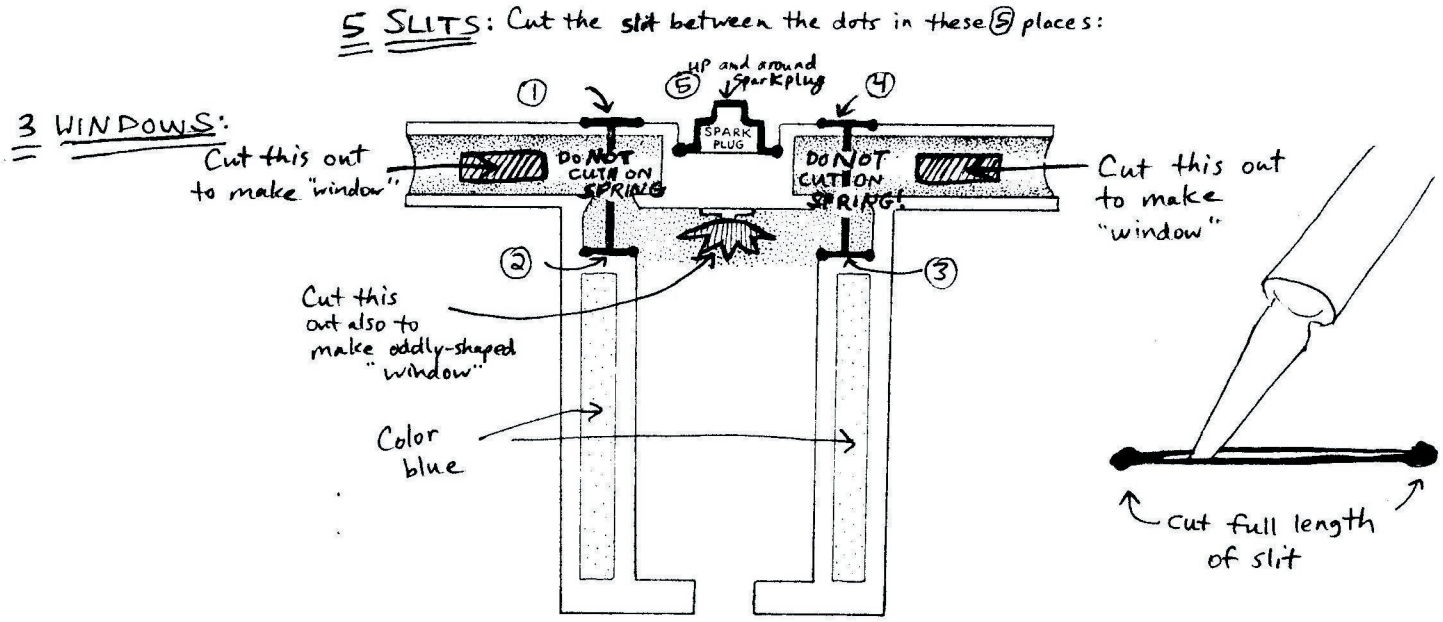
1) On parts page, color arrows red. Find part marked "THIS END DOWN" and color bright red between the two dotted lines.

2) Cut out all parts on parts page.

3) Glue the valves onto the arrow pieces, using VERY LITTLE GLUE. Be very careful not to put glue over the top of the line where it says NO GLUE. Use the tiniest little dab of glue so that it does not leak out all over!! Set these pieces aside to dry.

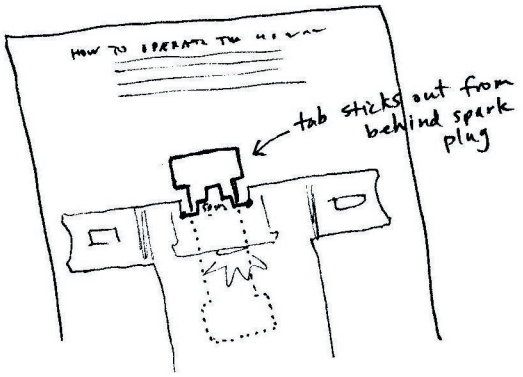


3) Using an X-acto knife make the following slits on the engine page:

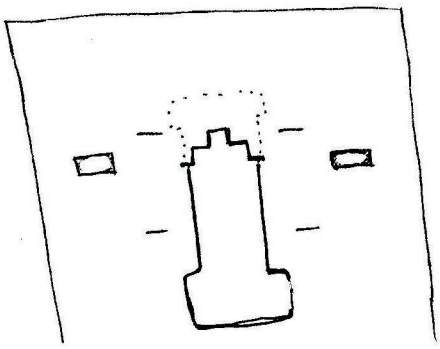


4) Color dotted area blue as indicated above. This is water. (coolant around hot piston cylinder)

5) Insert piece marked "THIS END DOWN" behind spark plug.

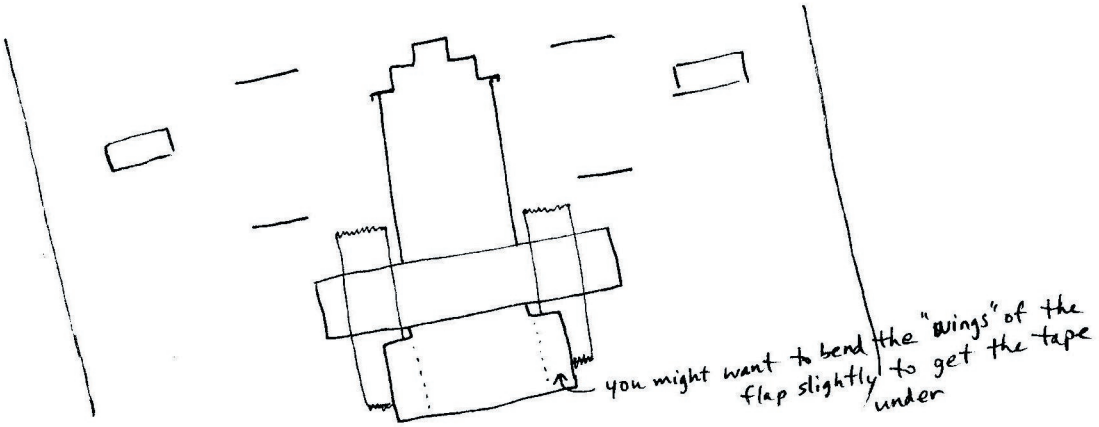


How it should look from the front.

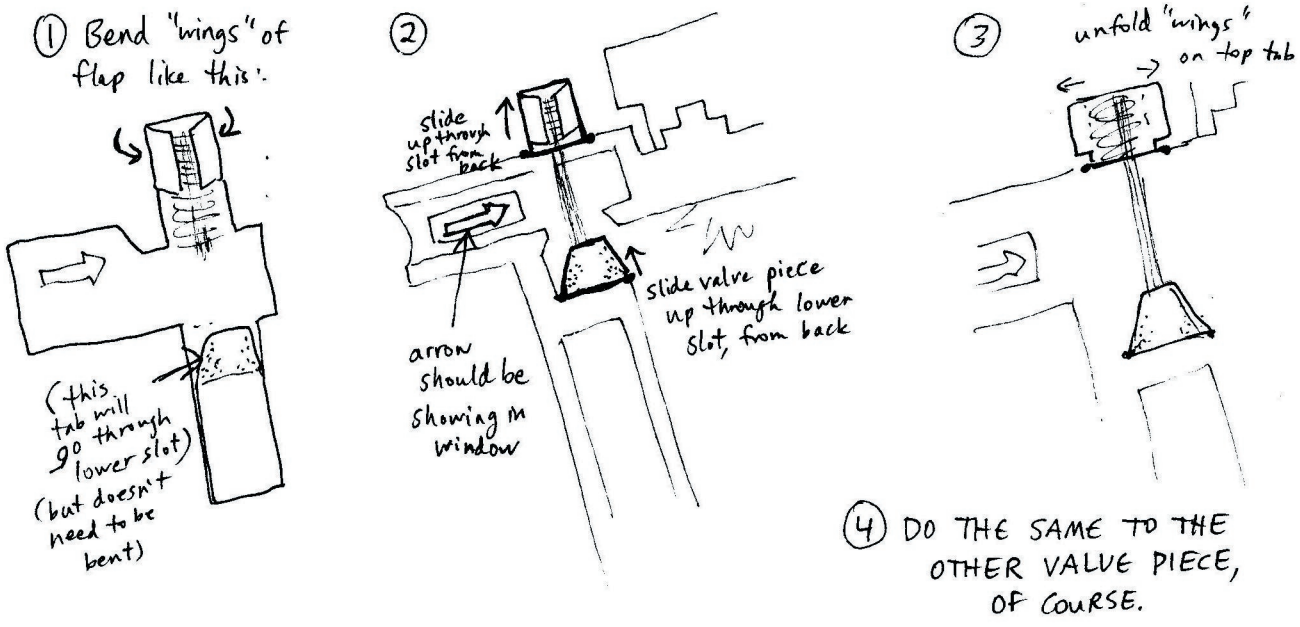


How it should look from the back.

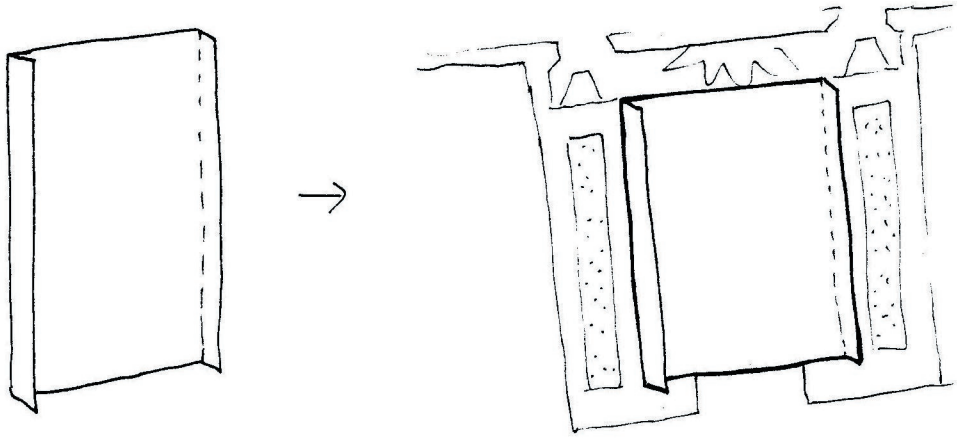
6) Looking from the front, pull tab up until red is just barely out of view. Hold it in place, and carefully turn paper over. Tape the long rectangular piece over the flap like this:



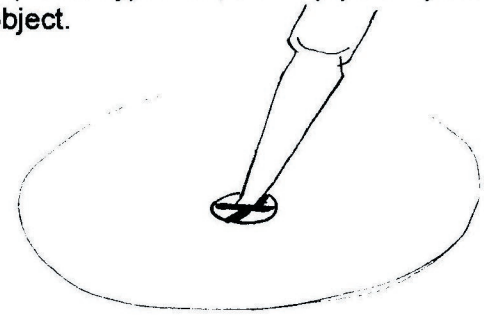
7) Assuming that your valve parts are reasonably dry, insert them into their slots like this:



8) Check to see that all three tabs move up and down smoothly.
9) Fold on the dotted lines on the cylinder, then glue into place.

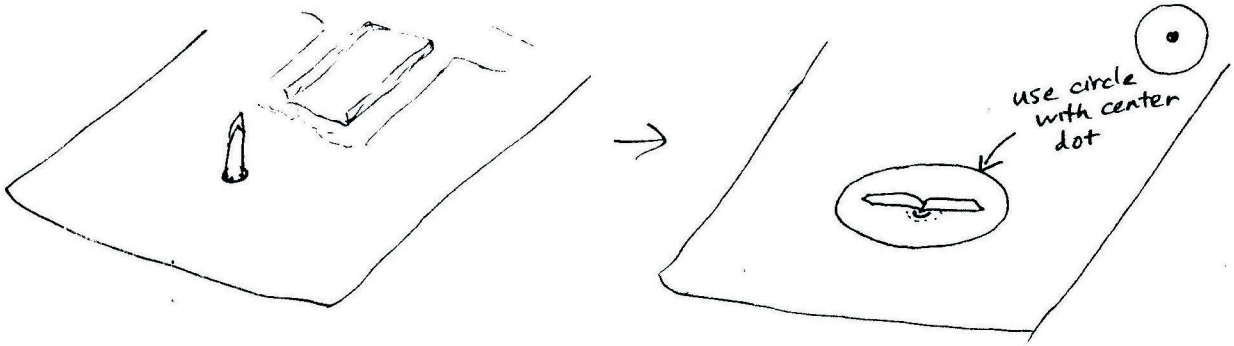


10) You will need to pierce "starter holes" for the paper fasteners wherever you see the circle with the X inside. (Don't forget the one on the engine page.) You can use the point of the X-acto knife (carefully) a nail, a sharp pencil point, the end of a scissor, or some other very sharp object.

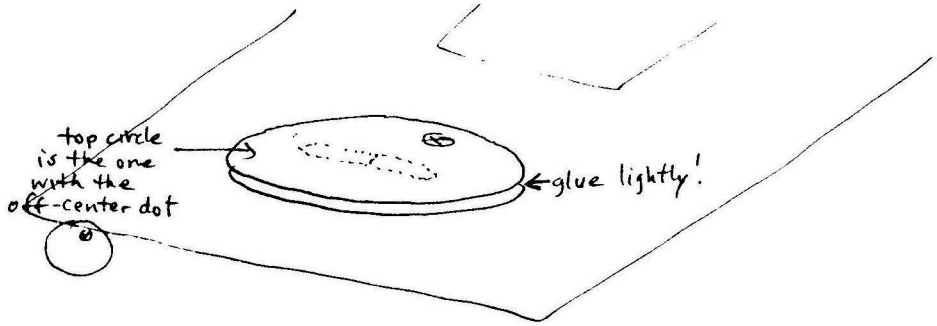


Do all the ⊗'s.
6 in all.

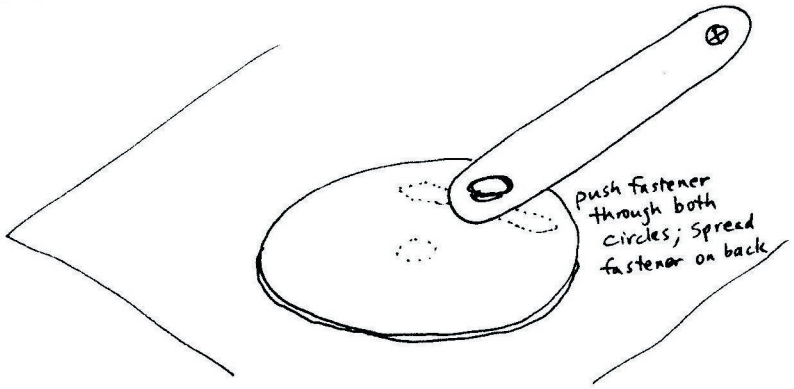
11) Poke a paper fastener up through the hole on the engine page, put the circle over it, and spread the fastener.



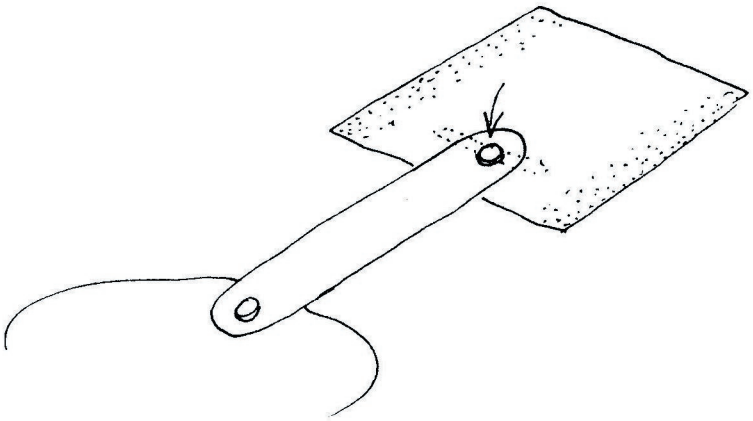
12) Glue the other circle on top of this circle.



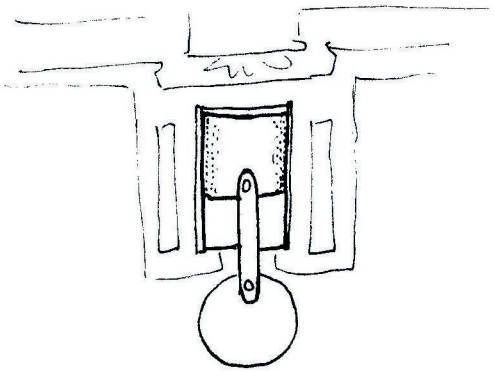
13) Use a paper fastener to attach the rod to the circle:



14) Use a paper fastener to attach the piston head to the rod.



15) Slide the piston head into the cylinder.



16) The piston head should go up and down smoothly in the cylinder. You may have to troubleshoot just a little if it doesn't work smoothly.

Twist the paper fasteners around a bit to loosen and enlarge the holes After the piston has gone up a down quite a few times it should do so smoothly without popping out of cylinder.
You may even be able to turn it by just putting a finger on the head of the fastener on the wheel