ENGRI 1170, Introduction to Mechanical Engineering
Cornell University, Fall 2009

Hand Tool Dissection Lab

(Modified Aug 30, 2009)

The purpose of this lab is to develop an understanding of the function and design of a consumer product. Most products involve many components with various functions. You will gain an understanding of these various design features and their interaction.

In this lab you will carefully take apart a cordless tool, determine how it works and then reassemble it to working condition.

TAs will distribute tools and Student Tool Boxes. At the end of the lab make sure your tool still works and that your toolbox is complete.

Before Dissecting the Tool:

1. Install the batteries and check that your tool works. If not, ask the TA for another.
2. Discuss with group members how you think the tool works on the inside prior to dissection.
3. Make sketches to show a few ideas the group comes up with.

Tool Dissection:

1. Take apart the tool that your group is given using the set of tools provided. If one member of the group is less experienced with tool use, that student should complete more of the disassembly. Proceed slowly and take careful note of the location of each part before removing it. For tricky disassembly steps, partially re-assemble before disassembling more. Remember that the tool must work after final reassembly. As you take apart the tool, record and answer the following:
2. Sketch the overall tool and its internal components. Label the different components.
3. How does it work? What are the different components used for? How is movement transferred from the drive mechanism (motor) to the useable part of the tool (drill chuck, oscillating blade, etc)? Sketch some of the components used to transfer this motion.
4. How are various moving parts mechanically supported? What kind of bearing surfaces, if any, are used in the design? Every bearing prevents some motions and allows others. For at least one of the interesting bearings in your device describe what motions are allowed, what are prevented and how these motions are allowed and prevented.
5. Measure and decide on three or four dimensions of some parts you think are probably needed by design engineers to design for strength, torque, air flow or other considerations. (e.g., shaft diameter for torque on drill, size of flow openings, fan dimensions, etc) Why do you think these dimensions are important in the operation or durability of the product?

6. Measure and record any other dimensions you believe are important. Note these on a drawing.

Reassemble the Tool:

1. Repair any problems such as broken wire connections. Ask TA for help as needed.
2. Reassemble the tool. How hard was it to reassemble? How long did it take? With training, how fast do you think it will take on a production line?
3. Are there location pins, alignment features, tapers, or other features that make it easy or hard to assemble? Is this an efficient design in terms of ease of assembly?
4. Completely reassemble the tool. Check that the tool works when handing it back to the TA.
5. Return the Student Tool Boxes to the TA. Make sure all tools are accounted for.

Please hand in next week at beginning of lab:

One lab report per group (Approximately 2 pages or less, plus any drawings). You can divide work between group members, but every member of the group should understand and be able to defend all parts of the report. Note the course academic integrity policies (on the course www site).

The lab report should contain the following:

- Brief introduction stating the purpose of the lab and what tool was dissected.
- Answers to any questions from this handout, including copies of any drawings you feel are important.
- Brief conclusion stating what was learned in this lab, any problems encountered, and any questions that you have about the design of the tool.