3 - Material Processing

Now that you understand where robot parts come from, either from stock material or as COTS components, it is important to understand how stock materials can be processed to manufacture custom parts. Generally speaking, this is done by the process of subtractive manufacturing, removing material from the stock to create the desired part. Although designers won't typically have to use these skills firsthand, it is important to understand how parts are made in order to design within the team's manufacturing abilities. This topic will explore each of the machines in Team 1732's shop to illustrate how parts can be made.

3.1 - Cold Saw

The cold saw, also known as the chop saw, uses a circular blade to cut metal that is clamped into place. It allows simple straight cuts perpendicular to the stock, as well as regular angles such as 30°, 45°, and 60° after some adjustment. It is the fastest tool for removing metal and is especially useful on tube and angle stock. However, its precision is usually fairly low and depends much on the skill of the operator.

Figure 1: A cold saw [TO BE REPLACED]
(image from HomeDepot.com)

3.2 - Band Saw

The band saw cuts material via a continuous blade that passes through the work piece. Unlike the cold saw, however, the workpiece is held only by the operator's hands against a table. This makes it cut much more slowly, but it also allows it to make gradual curved edges on the outside of the part. Its precision is also limited by the skill of the operator.

Figure 2: A band saw [TO BE REPLACED] (image from HarborFreight.com)

3.3 - Drill Press

A drill press consists of a chuck that can use any type of drill bit, which moves vertically to drill holes into material. The workpiece is held by a heavy clamp but is not secured to the table. It does not have great precision, again depending on the operator's skill, but it is the fastest method to create holes at greater precision than a hand drill would offer. The wide variety of drill bits available also allows flexibility. Any fractional size from 1/16" to 1/2" can be made with a twist bit, a step bit allows holes up to about 1 1/2", and hole saws can create holes a few inches in diameter.

Figure 3: A drill press [TO BE REPLACED]
(image from HarborFreight.com)

A twist bit (image from HomeDepot.com)

A step bit (image from HomeDepot.com)

A hole saw (image from HomeDepot.com)

Figure 4: Various types of drill bits [TO BE REPLACED]

3.4 - CNC Router

The CNC router is a computer-controlled machine that uses a chuck, similar to that of the drill press, which can move in the X and Y axes and can descend in the Z axis. The workpiece, which can be sheet or tube stock, is clamped to a table. This machine works automatically on computer commands, programmed into using computer-aided machining (CAM) software within Inventor. It can make a variety of shapes, including complex curves on both the inside and outside of parts, and It has great precision due to the computer control.

Figure 5: A CNC router [TO BE REPLACED]
(image from VeloxCNCRouters.com)

3.5 - Lathe

A lathe, is perhaps the most different from the other tools listed in this section. Instead of using spinning tools on a stationary workpiece, it uses stationary tools on a spinning workpiece. It spins the workpiece, typically a round or hexagonal piece of stock, in a chuck, and a tool holder allows a cutting tool to be placed anywhere along the length of the part to cut features. It also has a chuck to drill holes in the center of the part. Therefore, the lathe can only create circular features. Although it is not a CNC machine, the lathe has a Digital Readout (DRO) that displays the position of the tool holder, allowing great precision.

Figure 6: A lathe [TO BE REPLACED]
(image from PrecisionMatthews.com)