Manufacture a conventional stapler

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Introduction

Staplers are produced for use in: the manufacture of furniture; medical fields; carpet tacking; electrical wire and insulation installation; picture frame manufacture and, of course, in the home or office.

General Application

Staplers are most frequently used in binding multi-page documents and other such related office tasks.

General Size

While there is no specific standard size of staple, the basic household (office) type—with a wire size of. 017 of an inch in diameter—is generally accepted as typical.

Components

A stapler comprises many components, most of which are the metal stampings and spring type parts. Main components of a conventional home or office stapler include:

- The **Base** (the pedestal where all components connect with)
- The **Hanger** (which is welded to the base and holds the pin that connects the magazine and base)
- The **Cover** (which covers the subassembly where we put the staples in)
- The **Anvil** (the metal plate over which you put the document that you want to staple)
- The **Magazine** (functioned as a carrier which holds the staples)
- The **Metal head** (which covers the magazine)
- The **Springs** (they keep the row of staples lined up in the track and ready to be used, and they return the plunger blade to its original up position)
- The **Plunger Blade** (it separates one single staple from the row of staples each time it is forced down)
- The **Pin** (the hinge point for the top and bottom half)
- The **Rivet** (used to keep the parts together)
- The **Cap** (which is snapped on the cover part)
- The **Bottom Pad** (which is used as the feet of the stapler to make it anti-skid)

To determine which materials that we will use for manufacture a stapler, we need to know what are the mechanical properties or the requirements of each component.

The table below shows the main idea about the properties, materials and manufacturing methods.

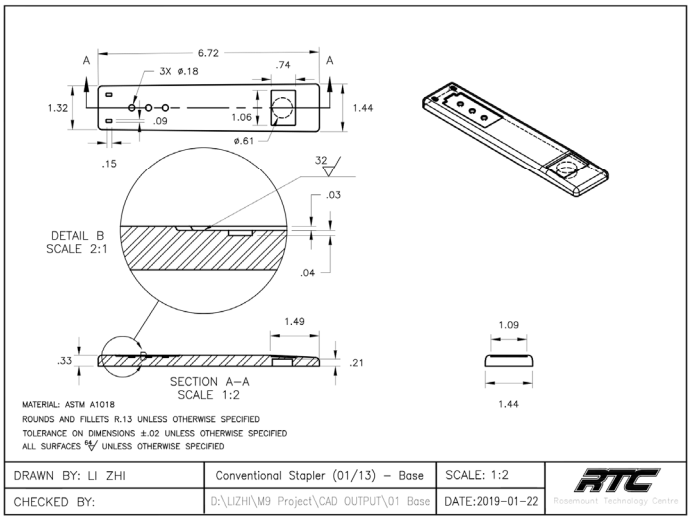
Components	Mechanical Properties or Requirements	Conventional Materials	Manufacturing Method
Base	Hard, Stiff, Easily Welded, Easily Machinable	Low Carbon Steel ASTM A1018	Stamping Flat Sheet Metal
Hanger	Hard, Stiff, Easily Welded, Easily Machinable	Low Carbon Steel ASTM A1018	Stamping Flat Sheet Metal
Cover	Hard, Stiff, Easily Welded, Easily Machinable	Low Carbon Steel ASTM A1018	Stamping Flat Sheet Metal
Anvil	Hard, Corrosion-Res, Light Weight	Aluminum Alloy AA 6061	Stamping Flat Sheet Metal
Magazine	Corrosion-Res, Wear-Res, Light Weight	Low Carbon Steel ASTM A1018	Stamping Flat Sheet Metal
Metal Head	Hard, Corrosion-Res, Light Weight	Low Carbon Steel ASTM A1018	Stamping Flat Sheet Metal
Springs	Elasticity, Light Weight, Corrosion-Res Very High Yield Strength	Stainless Steel SS 301 Spring-Tempered	Wire Drawing & Heat-treatment
Plunger Blade	Hard, Tough, Stiff, Corrosion-Res	Low Carbon Steel ASTM A1018	Stamping Flat Sheet Metal Heat-treatment
Pin	Strong, Stiff	Stainless Steel SS 304	Cutting Off Bar Stock / Forging
Rivets	Fairly Strong, Some Elasticity	Stainless Steel SS 304	Cutting Off Bar Stock / Forging
Cap	Easily Shaped and Colored, Cheap	ABS Plastic	Injection-Molding Painting
Bottom Pad	Anti-Skid, Vibration Absorb, Wear-Res	Synthetic Rubber SBR	Injection-Molding

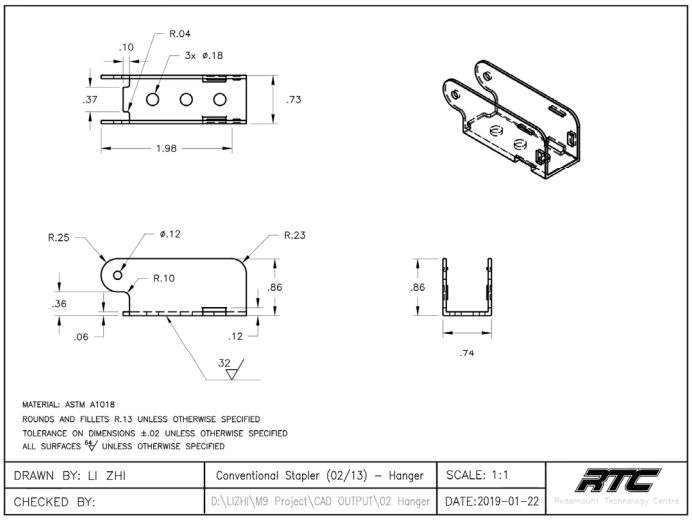
Drawing the components

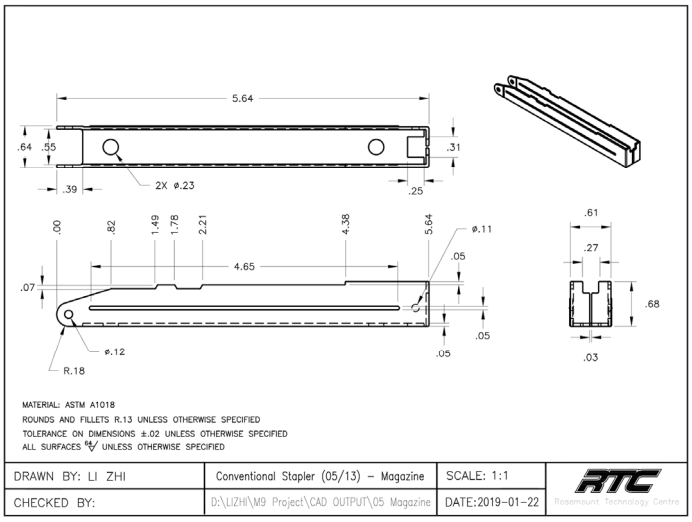
Now we can draw all the components with AutoCAD or other 3D-based softwares. After this step, we can then give them to the manufacturer to produce them.

Here are some drawings of the essential components.

*Notice: not all the components are listed below.



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DATE:2019-01-22
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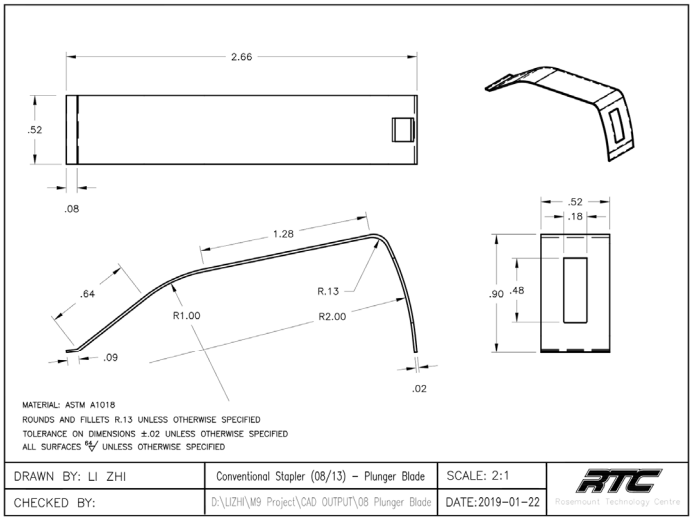
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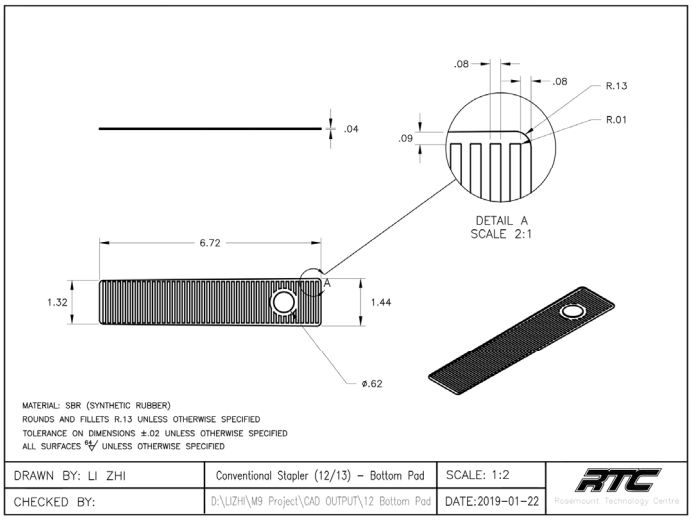
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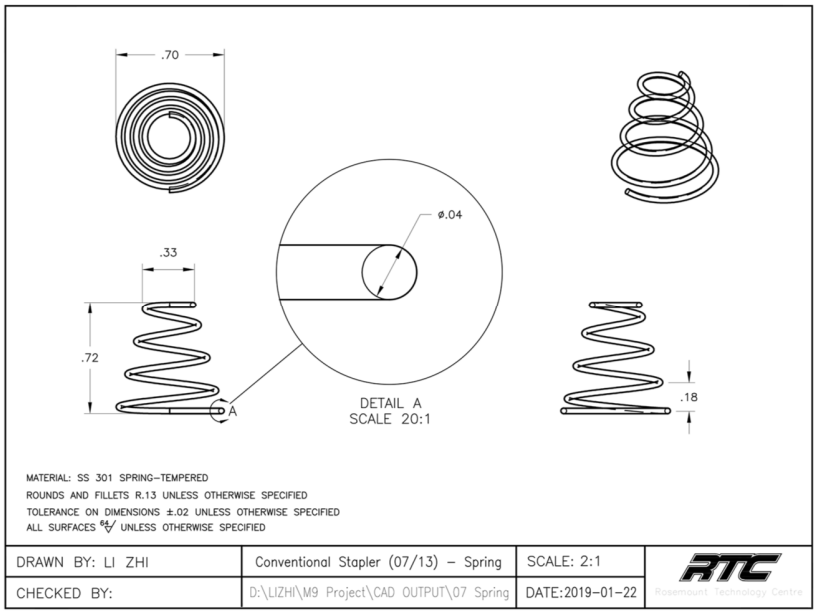
Manufacturing Process

Forming the springs

A spring is made from metal that has the ability to withstand a constant pressure and release and still maintain its shape. The spring material is wound around an appropriately sized rod (similar to winding a thin wire around a pencil) and is then **heat-treated** to a produce changes in the metal's characteristics — changes that give the metal "**elasticity**." The heat-treated spring can be pulled apart and pressed together, within reason, and still return to its original wound up condition.



Stamping of parts

Stampings are typically made of **flat sheet metal** material of varying thicknesses that are sandwiched between a punch and die. When the punch pushes on the material, it "shears" a piece of material (the shape of the punch) out of the sheet. Stamping material can also be in the form of a coil of material that looks something like a roll of paper towel. (The material type and thickness depends on the configuration of the part being made). The coil allows automatic feeding of the material across a punch and die using a coil feeder. The coil is gradually unwound as parts are stamped out of it. This is a very cost-efficient way of mass producing stampings because it does not require an operator to hold the material between the punch and die. Most of the major metal components besides springs and rivets, such as the **base**, **metal head**, and **anvil**, are made in this way.

Brake forming

After a part is stamped, it is usually then formed into a shape. If the shape is an intricate one, another type of punch and die is used. The material may also be **heated in order to soften** it, allowing the material to **bend more easily**. Most stapler parts have somewhat square corners, so typically the material is bent at 90 degree angles. There are now machines that perform stamping and brake forming processes during the same operation; they simultaneously punch out shapes and bend them to make the appropriate parts. This eliminates the amount of setups and different machines required to make all of the parts.

Rivets

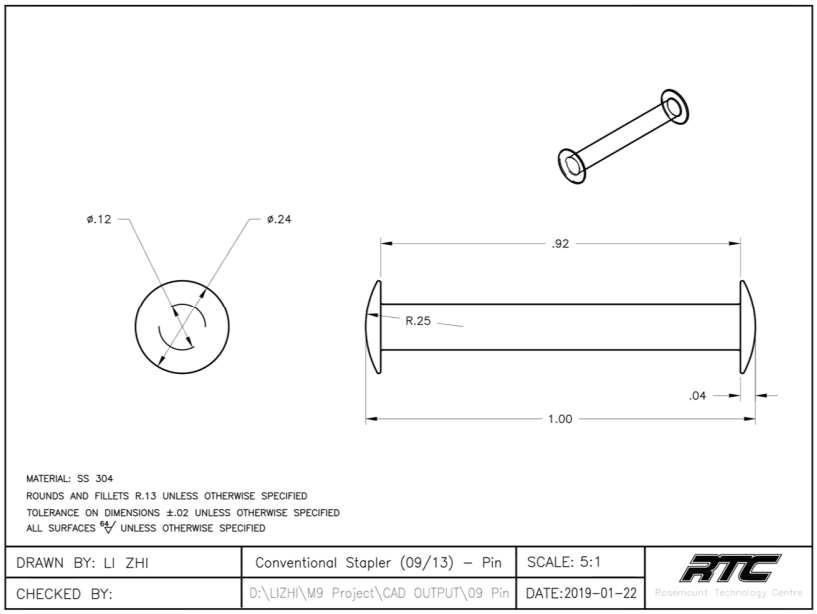
A rivet is usually made of a fairly **strong** steel material, but it must also have some **elasticity**. A rivet is designed to hold parts in place just **like a screw and nut**, except that the rivet is one piece and cannot be easily disassembled. One end typically has a head on it (**like a nail or a screw**), and the other end is usually hollow (either partially or along the whole length). Rivets are made by **cutting off** a piece of **bar stock** and forging it to obtain the desired configuration. **Forging** is a process similar to stamping, except that the starting material is almost to size already. Forging will minimally change the size and shape; the strength of the material, however, is significantly increased.

Creating plastic moldings

Plastic parts of staplers are made by **injection molding**, in which a liquefied plastic is injected into a die. The liquid flows into the open void and is then cooled. As the die cools, the plastic solidifies and takes on the shape of the die. The die is opened and the part is removed.

Making the pin

The pin is little more than a piece of bar stock, cut off to a certain length either with a saw or on a machining center. Because the pin is used as a hinge point for the top and bottom half of the stapler, it is usually made from a **strong, heat-treatable metal**.

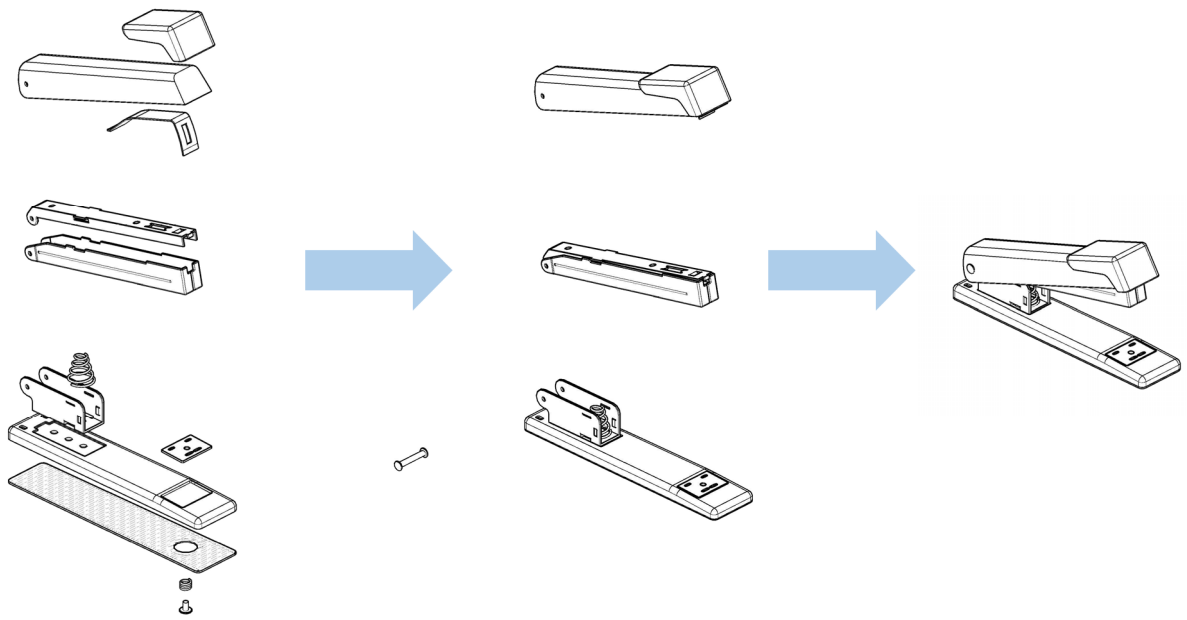


Painting

As required to prevent **rust**, or for **cosmetic** reasons, some of the components are painted. The parts are hung on small racks, set on a conveyor and passed by a spray nozzle. Some automatic painting operations employ electrostatic spraying, wherein the parts and paint are electrically charged. The paint and the parts are given opposite charges—for instance, the paint will be given a negative charge while the part will be given a positive charge—because opposite electrical charges attract each other. Electrostatic painting ensures that every possible space on the part will be evenly painted. This method also eliminates wasted paint (overspray).

Assembly

The **pins**, **stampings**, and **springs** are subassembled in stages and then assembled together with the upper and lower halves of the stapler frame.



For the bottom subassembly, consisting of the **base**, **hanger**, **anvil**, and **clearing spring**, the parts are placed in an assembly jig that holds them in position to allow the **rivets** to be placed in the correct holes. Once the rivets are locked in place, a tool called an orbital riveter spins the hollow end of the rivet until it collapses outward and captures the parts together.

The top half, consisting of the **magazine subassembly**, the **case**, the **follow spring**, the **driver-ram spring**, and the **metal head**, is assembled the same way in its own assembly jig.

The top and bottom halves come together in another jig, and the pin that connects the two is riveted into place. Finally, the finishing touches such as the feet (anti-skid rubber pads) and the plastic cap are then snapped on.

The Future

Staplers, like most other mechanisms, are continually adjusted and improved upon. As new materials and processes are developed, many uses become incorporated into all kinds of products, the stapler is no exception. Likewise the use for staplers will continue to increase as one of the latest uses is in the medical field as a substitute for stitches.