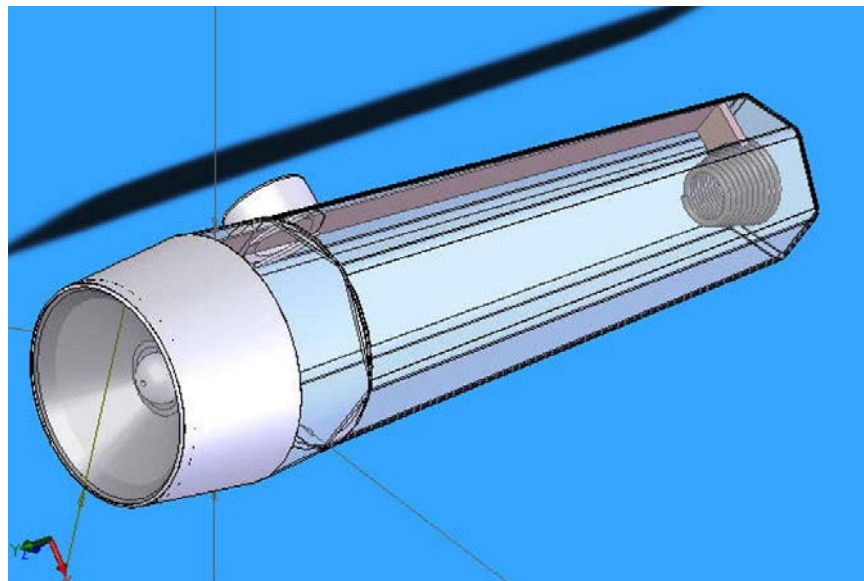


Components of a Flashlight

Engineering 112 - 502

Marwa Qaraqe
Mahmudul Alam
Maryam Manojahri



Introduction

In Engineering 112, we were asked to pick an object that we could take apart and later rebuild. We have chosen a small keychain flashlight. This flashlight is small, portable, and easy to use.

Description of Material

The purpose of the flashlight keychain is to provide concentrated light when needed. One of our group members found this flashlight in his home at no cost. The flashlight can be broken down into nine basic parts. The numbering of the parts of the flashlight in the text below corresponds to the item number in the exploded view of the flashlight located in figure 1 on the next page.

1. Main tube that accommodates the battery. The tube is made out of plastic and holds all of the parts of the flashlight.
2. Spring: The spring is made out of stainless steel and located at the end of the flashlight. This spring has two purposes. The first is that it pushes the battery upward so that it can touch the end of the bulb. The second purpose of the spring is that it connects the negative end of the battery to the rectangular copper wire.
3. Thin, rectangular, copper wire. The copper wire is shaped like the letter L. The bottom of the copper wire (the bottom of the letter L) is attached to spring. When the flashlight's button is pressed, the copper wire touches the conducting washer and therefore completes the circuit.
4. Button. The button is made out of plastic. This plastic button, when pushed, allows the rectangular wire to touch the conducting washer. This, in return, completes the circuit and the bulb lights up. When pressure is taken off the button, the circuit breaks and light turns off.
5. Conducting washer. The washer is made out of sheet metal steel. The washer is used to complete the circuit. When the copper wire touches the washer, the circuit is complete and the bulb turns on.
6. Small light bulb. The light bulb is made out of a glass bulb, tungsten filament, glass mount, insulation, electric foot contact, and support wires. The light bulb emits light.
7. The parabolic reflector. The parabolic reflector is also made out of plastic and is plated with a thin silver layer. The reflector's function is to reflect light.
8. Lens. The lens is circular shaped and made out of clear. This piece is located on top of the bulb and used as a protection device for the bulb.
9. Lens case. The lens case is made out of plastic and keeps the lens in place.

Below, figure 1, is an exploded view of the flashlight that was developed in a program called Solid Works.

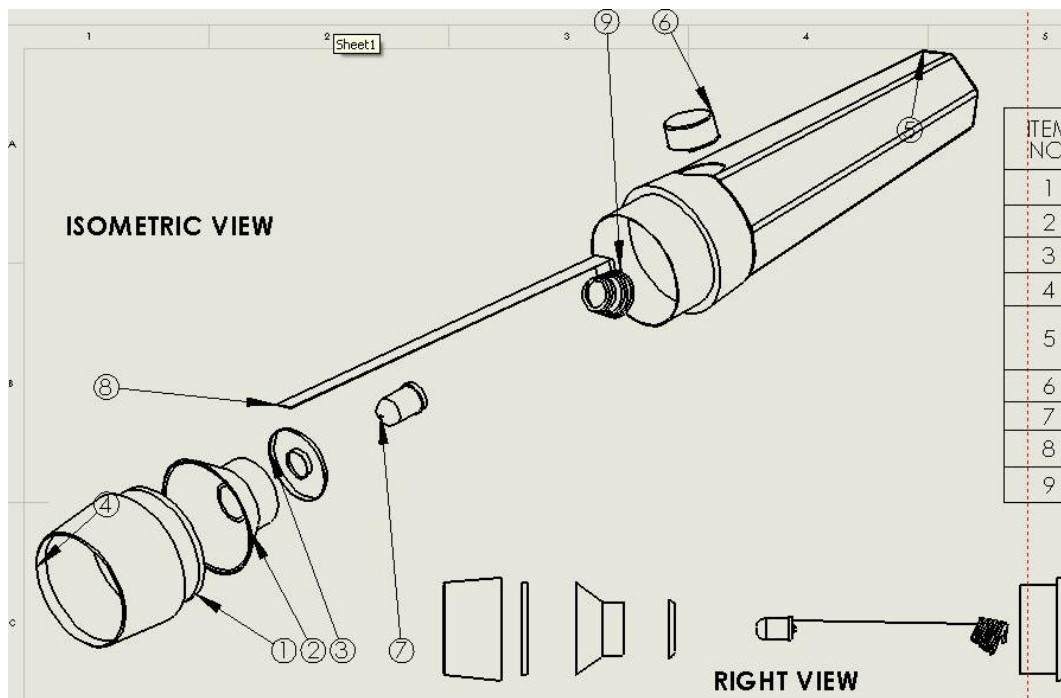


Figure 1: Exploded view of the Flashlight.

The following figure is a colored exploded view of the flashlight

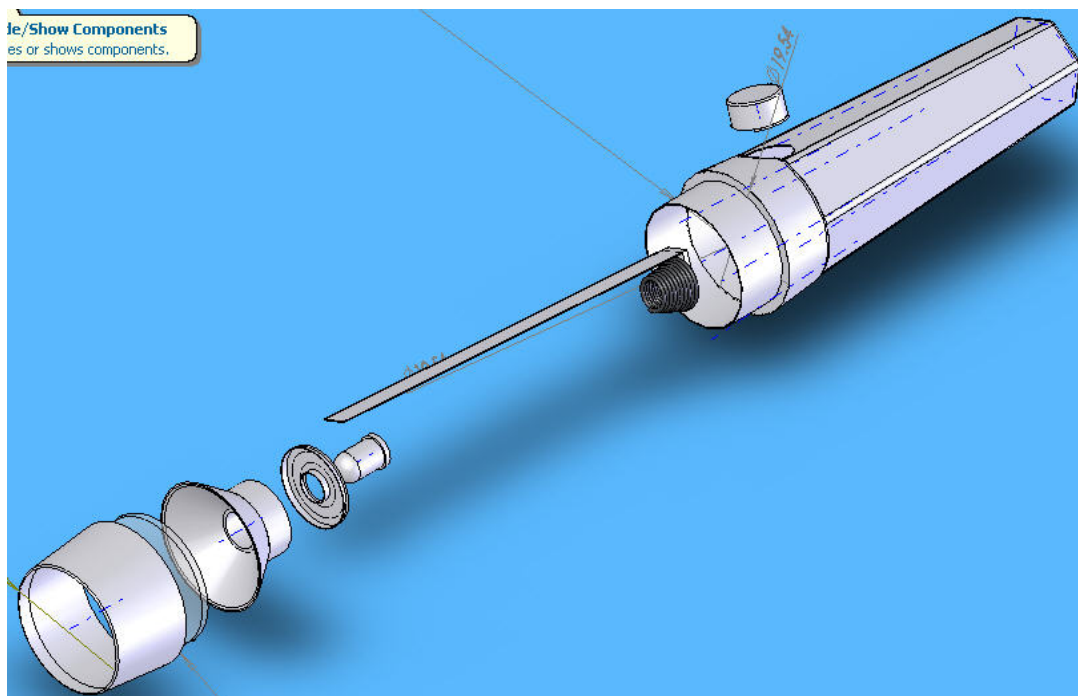


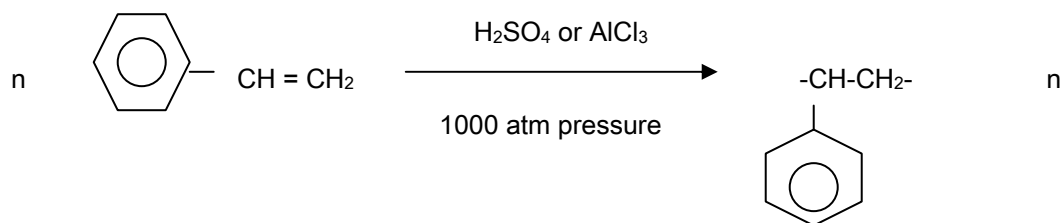
Figure 2: Colored exploded view of the Flashlight.

Neatest Part:

The neatest part of the flashlight is the parabolic reflector. A parabolic reflector is a device that commonly looks like a dish. The parabolic reflector has two basic functions; it either collects or distributes energy. The energy can be in the form of light, sound, or radio waves (Parabolic 1). In our case, the energy is in the form of light. The reflector allows light coming out of the bulb to shine with a larger area. The parabolic reflector is neat because without it the flashlight's efficiency would decrease. A flashlight is useless if the amount of light it produces is not sufficient enough to help us. Therefore, the parabolic reflector is a major part in the flashlight.

Manufacturing Process of the Flashlight:

The main tube of the flashlight that we have chosen was constructed from polystyrene, a durable polymer, which is typically used to manufacture packaging materials, insulator, and artificial rubber. As part of this process, first phenyl ethene, the chemical name of the styrene, was added with colorants and other plasticizing substances. After that the mixture was then heated under 1000 atmospheric pressure in the presence of Lewis acid like H_2SO_4 or AlCl_3 , and the reaction produced liquid polystyrene.



Phenyl Ethene

Poly Phenyl Ethene (Polystyrene)

Next, liquid polystyrene was injected into a previously designed hexagonal shaped casting matrix through an injecting nozzle. High pressure then was applied to ensure that the injected styrene fill the casting matrix completely and also to assist the walls of the cast to stand firmly against the hydrostatic force of the liquid styrene. As the temperature cooled down, the plastic hardened. After the complete solidification of the polystyrene, the casts were removed and the plastic part then underwent various refinement procedures like cutting and polishing before it got a smooth and elegant appearance. The whole manufacturing process has been illustrated in the following diagram:

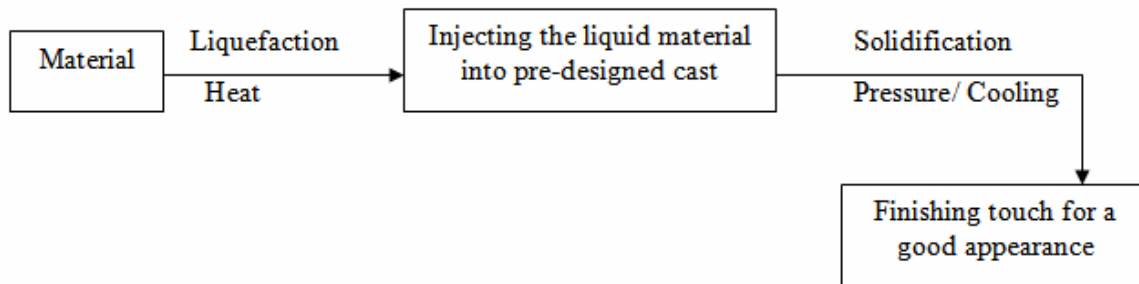


Figure 3: Common manufacturing process of the parts of the flashlight

The same manufacturing process, as shown in the figure above, was adopted for the manufacture of the lens case, the parabolic reflector, the washer, the conducting wire, the switch, and the spring. As for the switch, lens case, and the reflector, a different type of plastic was used, which is obviously softer than polystyrene. Unlike the switch and the lens case, the reflector is polished with aluminum, which was done with a view to enhancing its reflecting capability. The copper wire was manufactured from copper while the spring, the washer, and the glass mount of the bulb were manufactured from iron. During the manufacturing process, the spring, the washer, and the glass mount was plated with stainless steel to prevent them from being rusticated.

The light source of the flash light is an indecent bulb, and this consists of a tungsten filament encircled in a spherical glass enclosure. As part of its manufacturing process, the filament was first welded in two contact wires, which stand on the cap of the glass mount. The whole system was then placed in a low pressure chamber filled with inert gases, and then heat was applied to seal the spherical glass enclosure with the glass mount.

Rebuilding the Flashlight

Assembling the parts of the flashlight is fairly simple. There are several steps to follow as mentioned below. Figure 2, on the following page, is an exploded view of the Flashlight. The figure will help in

visualizing the parts and how they are connected to each other. Attach the spring the bent part of the copper wire and place inside the plastic tube.

1. Attach the plastic button to the copper wire.
2. Fit the button to the plastic tube so that the button protrudes from the hole inside the plastic container.
3. Place the bulb inside the conducting washer so that the bulb goes through the middle of the washer. Make sure the glass part of the bulb and the hollow part of the washer face the same direction.
4. Fit the bulb and washer to the parabolic reflector. The hollow part of the washer should snap into place with the reflector.
5. Place the reflector on top of the container so that metal tip of the base of the bulb sticks out. The reflector should just sit on top of the container.
6. Place the clear plastic lens on top of the parabolic reflector.
7. Screw the lens case on the plastic container.

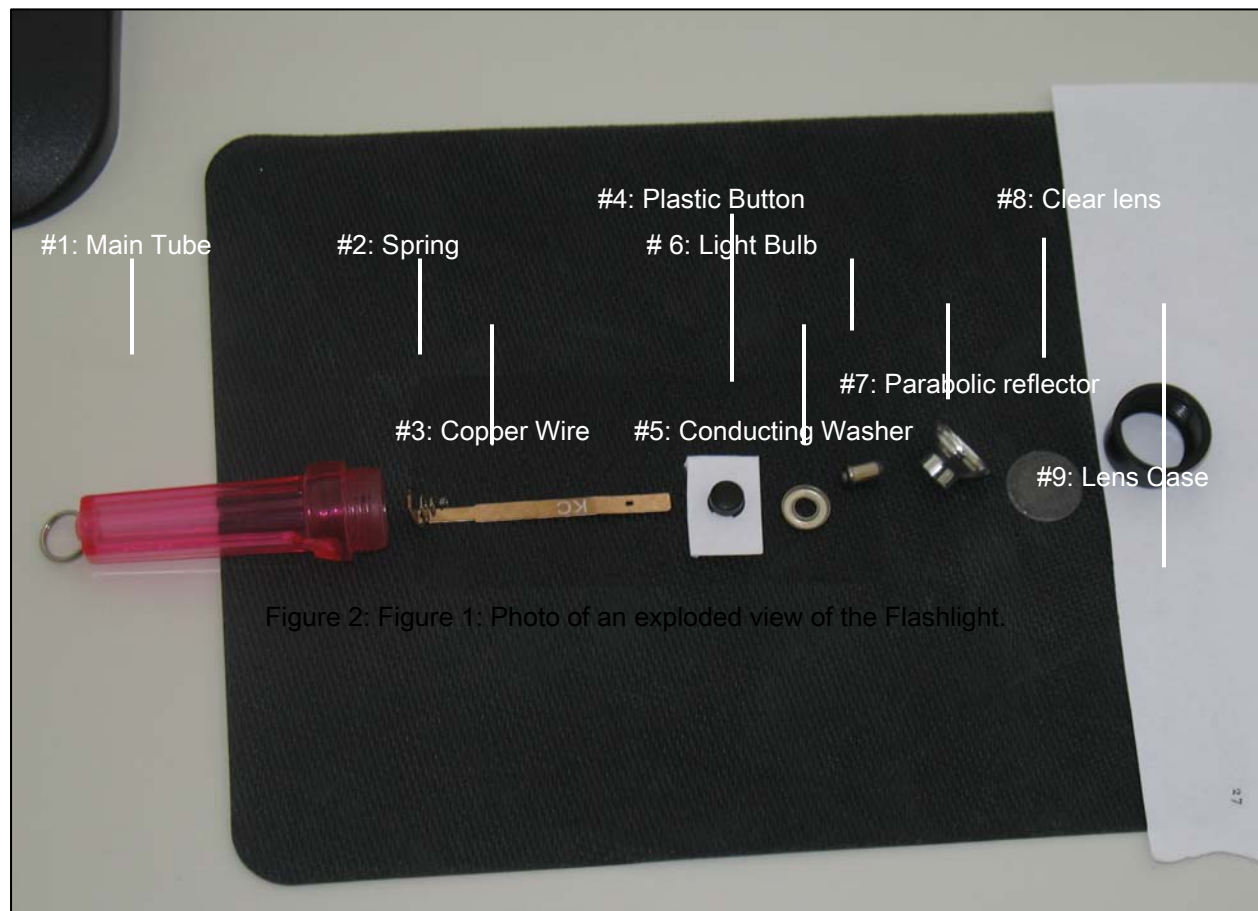


Figure 4: Components of the Flashlight.

Recommendation

The keychain flashlight can be improved if instead of a button there was a switch to turn on the light. Pushing a button to activate the light can get frustrating after a while because the second pressure is lifted from the button, the light turns off. However, a switch enables a person to use both of their hands because they are no longer using one hand to hold the button down to turn on the light.

Work Cited

"Parabolic Reflector." Parabolic Reflector. 18 Feb. 2007. Wikipedia. 22 March 2007.

<http://en.wikipedia.org/wiki/Parabolic_reflector>