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Materials and Manufacturing: Materials and Construction methods

The product I have deconstructed is a motorised lint remover. This product is usually found as a manual roller, that's placed over fabric to remove residual lint. Although this product could be considered a lazier way of removing lint, it's practical and longer lasting than sticky lint rollers.

The lint remover was invented in 1955 by American electrical engineer, Nicholas McKay. According to Joanne Gordon, McKay "wrapped masking tape around a cardboard toilet paper roll and stuck that on a mangled wire hanger". McKay's 'accidental' creation was soon patented the "Lint Pic-Up". Due to the success of the product McKay and his wife Helen, started the business *HelMac Products*. It went into national distribution in 1968 and was available in 60,000 retail locations by 1973.

The motorised lint remover that I've deconstructed and analysed includes several different components and materials. Each component has been manufactured and assembled to their own specifications, before being assembled to create a battery-operated lint remover.

Bill of materials and assembly/construction methods

Part	Quantity	Material	Manufacturing Method
Blade	3	Spring steel, ABS	Progression press tool
ON/OFF Switch	1	ABS	Injection moulded
Battery compartment	1	ABS	Injection moulded
Lint container	1	PP	Injection moulded
Protective Cap	1	Polycarbonate	Injection moulded
Glide piece	1	Spring Steel	Progression press, Chrome plated, Overmoulding
Main Body	1	ABS	Injection moulded
Blade compartment	1	ABS	Injection moulded
Screws	2	Low Carbon steel	Thread rolling
Thread-forming screws	3	Low Carbon steel	Thread rolling
Motor	1	Low Carbon steel	Progression press tool

After deconstructing and analysing the product, I've researched the materials and manufacturing processes used to create the product. These include spring steel, polypropylene and low carbon steel. These materials have been processed in several ways to create the final product such as progression press tooling and injection moulding.

Spring steel is an alloy with high yield strength that can withstand a substantial amount of twisting or bending without any distortion (Weinhandl, 2017). Products made from this material are easy to bend or compressed (BSS Spring Steel Strip). In the lint remover, the blade and the glide piece have been made with this material. Spring steels have a medium-to-low carbon content and includes silicone, which creates the high yield strength in the material (Total Materia, 2012).

Acrylonitrile Butadiene Styrene (ABS), is a thermoplastic that has a wide range of properties (Plastics International). As a thermoplastic it can be heated to a liquid form and injection moulded or used for 3D printing; it's easily recycled to create a multitude of products. Due to its low melting temperature, ABS is extremely easy to mould. In comparison to other thermoplastics, ABS is inexpensive, therefore cheaper to create products (Rogres, 2015). Compared to HIPS, ABS have higher tensile strength and impact resistance (Curbell Plastics), therefore, better for home appliances like the lint remover.

Polypropylene (PP) is a thermoplastic that's used for a variety of applications. The material has a slippery surface that makes it a good substitute for plastics like POM for its use on gears and household furniture. As PP has been used for the lint container, its translucency would help the user to identify if the container requires emptying (British Plastics Federation). PP is also a low-density plastic in comparison to other common plastics. Manufacturers would benefit from its lightness when producing injection moulded PP parts. PP is moisture resistant, so if the lint remover meets any moisture, PP would help to ensure no damage would come to it (Creative Mechanisms, 2016).

Polycarbonate (PC) is a transparent thermoplastic. It's tough and extremely stable. According to the *British Plastics Federation*, PC is one of the "fastest growing engineering plastics... [where] global demand for PC exceeds 1.5 million tons". Most industries use PC for its "durability, cost effectiveness and appearance".

Generally low carbon steel has less than 0.3% carbon to be considered low carbon (Litherland, N. Hunker). It has great formability and easier to make into shapes through forming or pressing. This allows it to be created into parts like nails or screws. It's generally the most commonly used form of carbon steel, as it's the most cost effective compared to other carbon steel and metals (Process Industry Forum).

According to GTMA, progression press tools are used greatly in the manufacturing industry. As they can carry out different tasks like cutting, punching and bending simultaneously once pre-loaded, they are great for quickly producing parts and components at high volume. Compared to combination tools, progression tooling has an element of automation, reducing the human input. This can aid tool life and improve quality. A progression tool is cheaper to run compared to a combination tool and more cost effective for manufactures (Bolton, 2016).

Injection moulding is one of the main processes for producing plastic components. It's an automated process that creates large quantities of identical items for mass production quickly, thus reducing manufacturing costs. The most commonly used materials for injection moulding are thermoplastics like ABS and PP (British Plastics Federation). Compared to other types of plastic moulding, injection moulding is simpler, more reliable and "extremely efficient" form of moulding (Nanomold Coating, 2014).

Chrome plating is the process of applying a thin layer of chromium onto a metal alloy like spring steel, through an electroplating procedure (Surface Engineering Association). It improves the resistance against wear and corrosion, ensuring that parts will last longer after day to day use. Chrome plating a metal part creates a nice finish to the part if it's visible on the product, making the product more appealing to the consumer (Hard Chrome Specialists).

Thread rolling is a method used to produce strong, smooth and uniform thread forms. Unlike other threading processes like cutting, grinding and chasing; thread rolling is done by cold forging. It has better tensile and fatigue strength which makes it great for creating screws. This creates a higher quality screw than by machine-cutting (Horst Engineering). It avoids cutting away material, reducing any weakness in the metal (How Products are Made).

For future product development the manufactures could consider reducing the thickness of the moulded parts. Uniform wall sections reduce the cooling and the cycle time, making the components cheaper to manufacture. The thickness of the outer casing could be reduced to improve uniformity.

Although standard carbon steel is relatively inexpensive, the use of a high-grade sintered tool steels and wear resistant coatings would be beneficial for tooling. Although more expensive, it increases tool life and reduces maintenance costs, thus improving overall production outputs.

To summarise the lint remover is a well manufactured product that will most likely still be in production for years to come.

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Materials and Construction methods

Screws: Low Carbon Steel,
Thread Rolling

Glide piece: Spring Steel,
Progression pressed,
Chrome plated

Lint Container: PP
Injection Moulded

On/Off Switch: ABS, Injection
Moulded

Blade: ABS, Spring Steel
Progression
Press Tool

Blade Compartment:
ABS, Injection
Moulded

Motor: Low Carbon Steel,
Progression Tool

Main Body: ABS,
Injection Moulded

Thread-forming Screws:
Low Carbon Steel,
Thread Rolling

Protective Cap: Polycarbonate,
Injection Moulded

Battery Compartment: ABS,
Injection Moulded

