Spraying

Spraying is a finishing technique that employs a spraying device, usually coupled with compressed air, to air-spray a workpiece with a choice of coating. Coatings can differ between fabric, dye, print, and various other materials.

Airbrushes and spray guns are the two main devices used for industrial spraying. They are distinguishable by their sizes and by the size of spray the pattern they produce. While airbrushes are hand-held, they are typically applied to projects that require a greater amount of detail such as fine art or photo retouching. The equipment used with spray guns is generally quite large. Spray guns are typically well suited for covering large surfaces with an even liquid coat. Their interchangeable heads allow users to spray different patterns and they can be either automated or handheld.

For textile finishing, the spray technique has been developed in the context of conservation of water. The process provides flexibility in terms of location-specific deposition, easy maintenance, and a high level of uniformity by uniform droplet size. Additionally, this technique requires less water, chemicals, and energy for drying and curing. Different types of functional finishes, such as antimicrobial, softness, hardness, and water repellent, can be applied by this technique. Foam finishing is another approach to reduce the water consumption and processing.

The Southern Pacific countries stakes claim to one of the original uses of spray finishing as far back as the 1880's.

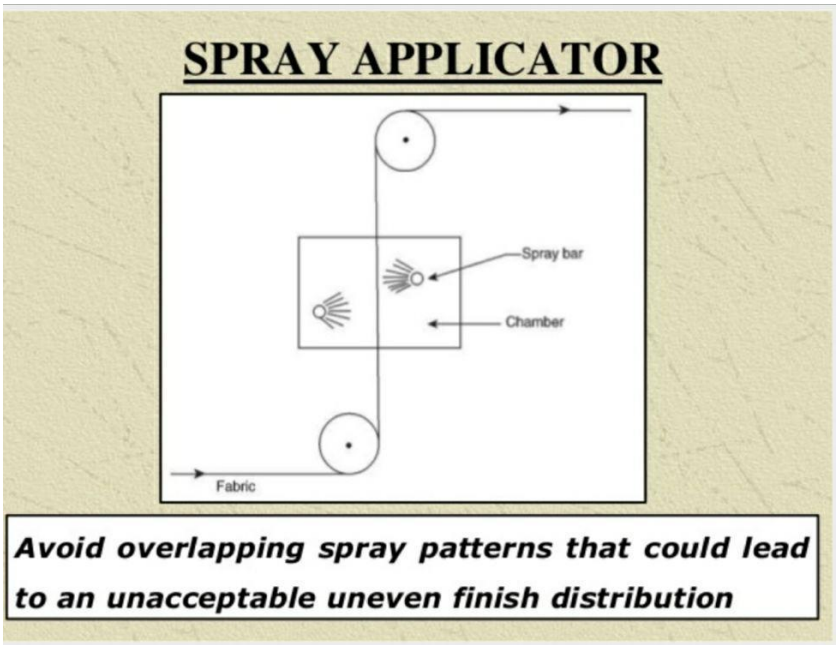
A textile company, is given credit for making spray finishing portable in 1949 following his invention of mixing aerosol and chemicals in a can while attaching a spray head to effectively disperse an finishing coat of chemical on fabrics.

There are numerous spraying techniques. They include air atomized systems, High Volume Low-Pressure gun (HVLP), and airless spray guns.

- **Air atomized systems** are the most conventional systems and combine compressed air and chemical, therefore producing small atomized particles. This technique offers a good finish quality at a fast rate and can cover complex shapes with indented areas. Different paste consistencies can be achieved thanks to a wide range of nozzle shapes and sizes.

- **A High Volume Low-Pressure Gun (HVLP)** is similar to the conventional method but differs in terms of a reduced spray velocity due to the use of different air and fluid nozzles.
- **Airless spray guns** produce a soft spray by forcing paint through a very small opening using hydraulic pressure. The atomizing nozzle's internal passageway is shaped in a manner that is mechanically driven into a highly unstable, typically fan-shaped, form.

In addition to the above techniques, spray booths are used to finishes delicate fabrics in companies. The booth is a pressure-controlled, closed environment that carefully creates the ideal temperature, airflow, and humidity conditions as well as ventilation that exhausts toxic particles to reduce and control air pollution.



Powder coating

Powder coating uses a free-flowing, dry powder to coat fabric pieces. It is mainly used for coating metallic finish in order to create a harder, tougher finish than conventional finishes.

Typically, thermoplastic or thermoset polymers are electrostatically applied and

cured with heat, enabling them to flow and develop what's known as a "skin." Curing time is significantly faster than it is with liquid coating. Unlike conventional liquid fiinishes, powder coating can keep the binder and filler parts in a liquid suspension form without the need for a solvent. Thanks to technological advancements, a greater scope of materials, such as Medium-Density Fiberboard (MDF), can be applied as part of the powder coating process.

Powder coating can produce thicker coatings than conventional liquid coatings and, because of its powdered state, it is free from running and sagging. The absence of solvents means that power coating releases little or no Volatile Organic Compounds (VOC) into the atmosphere, providing remarkable cost savings in terms of pollution control equipment. Aesthetically, there are fewer differences between horizontally and vertically coated services when compared to liquid coated items. Powder coating is also distinctly unique in that it facilitates a wide range of specialty effects.

The process is similar to the liquid spraying method. It begins with preparing the fabric piece and the equipment to be used. It is critical that the fabric piece is free from oil, dirt, lubrication greases, metal oxides, etc. before applying powder coating. There are several possible application processes such as an electrostatic gun, electrostatic fluidized bed, and electrostatic magnetic brush powder coating. The final step of the process is the curing process.

The most common application process for objects involves spraying the powder with an electrostatic, or corona, gun. A wide variety of spray nozzles are available.

- **Electrostatic spray guns**, also called **liquid electrostatic sprays**, pertains to the concepts of charge and electric fields. The finishing technique of applying a coating to a surface is based on the law of attraction between positively and negatively charged particles
- The **electrostatic fluidized bed process** is similar to the conventional fluidized bed dip process except, in this process, the powder depth in the bed is shallower.
- Lastly, **Electrostatic Magnetic Brush (EMB)**, uses a roller to apply the powder coating to flat materials, consequently resulting in relatively high speeds and accurate desired thickness layers.

Curing thermoset powders involves exposing the fabric piece to elevated temperatures for a set duration so that the powder melts, flows out, and

chemically reacts to harden and dry. The process, known as crosslinking, requires exposure to elevated temperatures for a certain length of time in order to fulfill the desired properties.

Dip coating

Dip coating is a powder coating process that involves immersing, or dipping, a substrate into a solution of coating material at a constant speed. It is an industrial process used to manufacture high-volume products such as coated fabrics or prophylactics as well as for specialized coatings in the biomedical field. Numerous chemical and nanomaterial engineering research processes are used in academic research to study the use of dip coating to create thin film coatings. The dip coating technique can deliver a uniform, high-quality film even on bulky, complex shapes.

The earliest application of dip coating is presumed to have been in candle fabrication. Similar to candle making, modern-day substrate dip coating involves repeating the process, until the coated material is built up, therefore resulting in a relatively thick final object. Dip coating can be performed as a continuous roll-to-roll process for flexible laminar substrates (like fabrics). Conversely, 3D objects can simply be inserted and removed from a coating bath while objects like prophylactics are dipped into the coating.

The dip coating process involves five stages:

- Immersion
- Start-up
- Deposition
- Drainage
- Evaporation

Once the dip coating process is complete, the final product may incorporate both the substrate and the coating or the coating can be peeled off so that the object consists only of the dried or solidified coating (as with prophylactics).

Academic research projects study certain nanoparticles used as coating materials through dip coating finishes. The applications involved include: multi-layer sensor

coatings, implant functionalization, hydrogels, Sol-Gel nanoparticle coatings, self-assembled monolayers, and layer-by-layer nanoparticle assemblies.