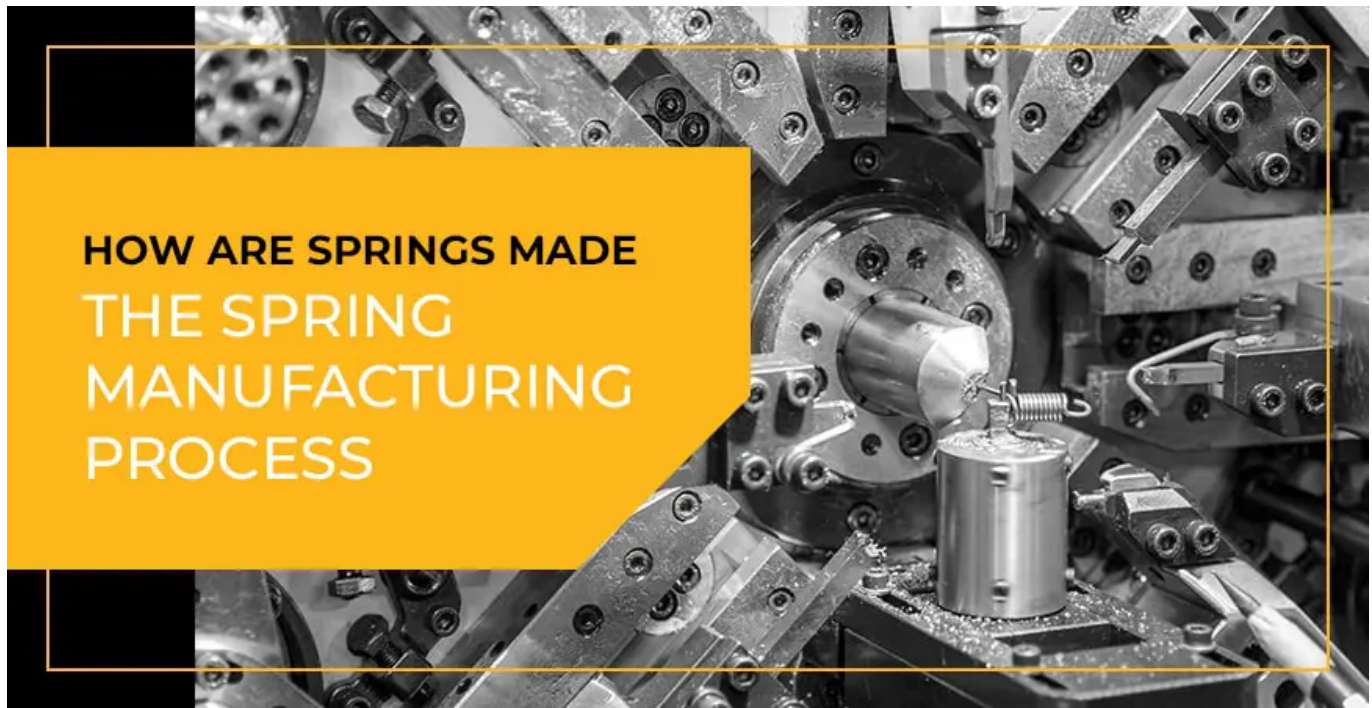


ARTICLES

How Are Springs Made – The Spring Manufacturing Process

Posted on **May 21, 2021** by IDC Spring

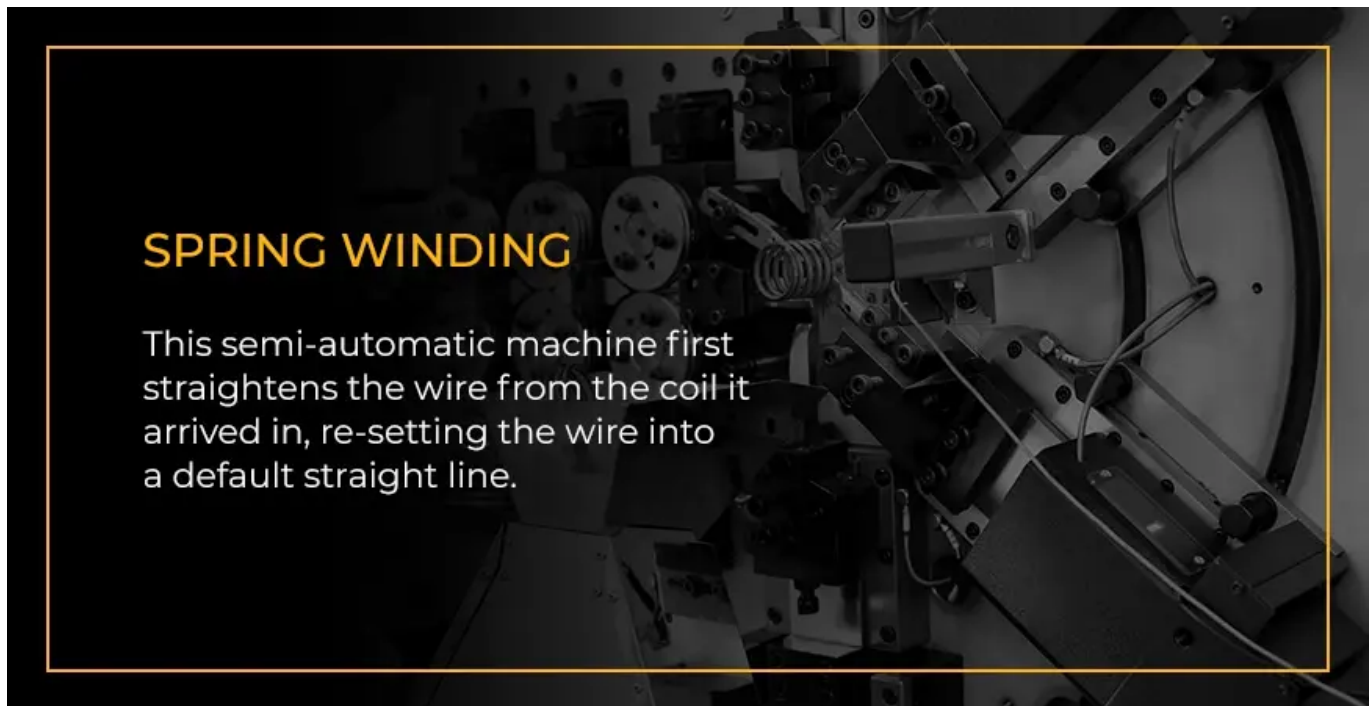


Mechanical springs are practically everywhere. From mattresses and consumer products to industrial machinery, the spring is ubiquitous. These coiled devices store mechanical energy, providing tension and compression in various applications. While the average person knows what a spring is and what it looks like, most don't know how springs are made or what they are made of. Here, we will discuss the process of manufacturing springs, how this process varies and what springs are made from.

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The process of manufacturing springs is fairly straightforward, with some variations based on the type of spring being made. In their most basic variation, springs are created via a process of winding, heat treating, grinding, coating and finishing.

These steps are explained in detail below:



1. SPRING WINDING

First, the spring wire is fed into mechanical spring machinery. This semi-automatic machine first straightens the wire from the coil it arrived in, re-setting the wire into a default straight line. From there, the machine coils, forms or bends the spring wire into the desired shape. These processes are described in more detail below:

- **Coiling:** Coiling utilizes a spring coiler or computer numerical control (CNC) spring coiler machine. The technician operating the machine sets it up to prepare it for the specific type of coil being made and feeds the wire into a set of rollers, which pulls the spring wire toward a set of guides. Eventually, the guides lead the wire to a coiling point or set of coiling points, which coil the wire backward to form a spring. This type of mechanism makes compression, extension and torsion springs.
- **Forming:** This is done using a spring former or CNC spring former machine. In this type of machine, there are six to eight tooling slides on the face, which enable it to perform several types of bends, hoops and radii in addition to the spring coil. As a result, this process can create a range of spring shapes. Spring formers are often used to make extension springs, torsion springs, wire forms and sometimes compression springs.
- **Bending:** Wire bending utilizes a CNC wire bender, which is a mechanical wire-bending machine controlled by a computer. The machine works by feeding the wire into a set of rollers, which pull the wire to wire guides and push it to a moveable tooling head, controlled by the computer. The tooling head performs various bends and shapes. The wire bender is mostly used to create wire forms.

These processes are used individually or in combination to create springs for various industries and products.

2. HEAT TREATING

Once a spring is formed, it typically needs to undergo a stress-relieving process, which will allow the spring to retain its memory. This memory allows the spring to bounce back when placed under stress. To accomplish this, manufacturers must heat treat springs after they are formed.

In the heat treating process, the spring manufacturer must heat treat the spring to a specific temperature for a specific amount of time. The temperature and time setting varies depending on the type and amount of wire involved. Once this is done, the spring may go through additional heat treating steps, quenching or cooling down the spring before putting it through another round. The exact process, again, depends on the type of material and the manufacturing process involved.

In most modern spring manufacturing processes, heat treating is done using a conveyor belt oven. When a spring comes off a spring machine, it falls down a slide and

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The spring then moves along the conveyor belt within the oven, traveling at a speed that allows it to stay in the oven for an appropriate amount of time. When the spring comes out of the oven, it is conveyed to a receiving box to cool down.

3. GRINDING

Grinding may be applied to compression and coil springs if the design calls for it. In the grinding process, the ends of the spring are ground flat, allowing it to stand up straight without wobbling when oriented vertically.

Spring grinding is accomplished using a spring grinder. This grinding machine has two horizontal grinding wheels, spaced apart in a way that allows the length of the spring to enter between the wheels. A separate part called the spring dish holds the spring and slowly moves it between the two grinding wheels.

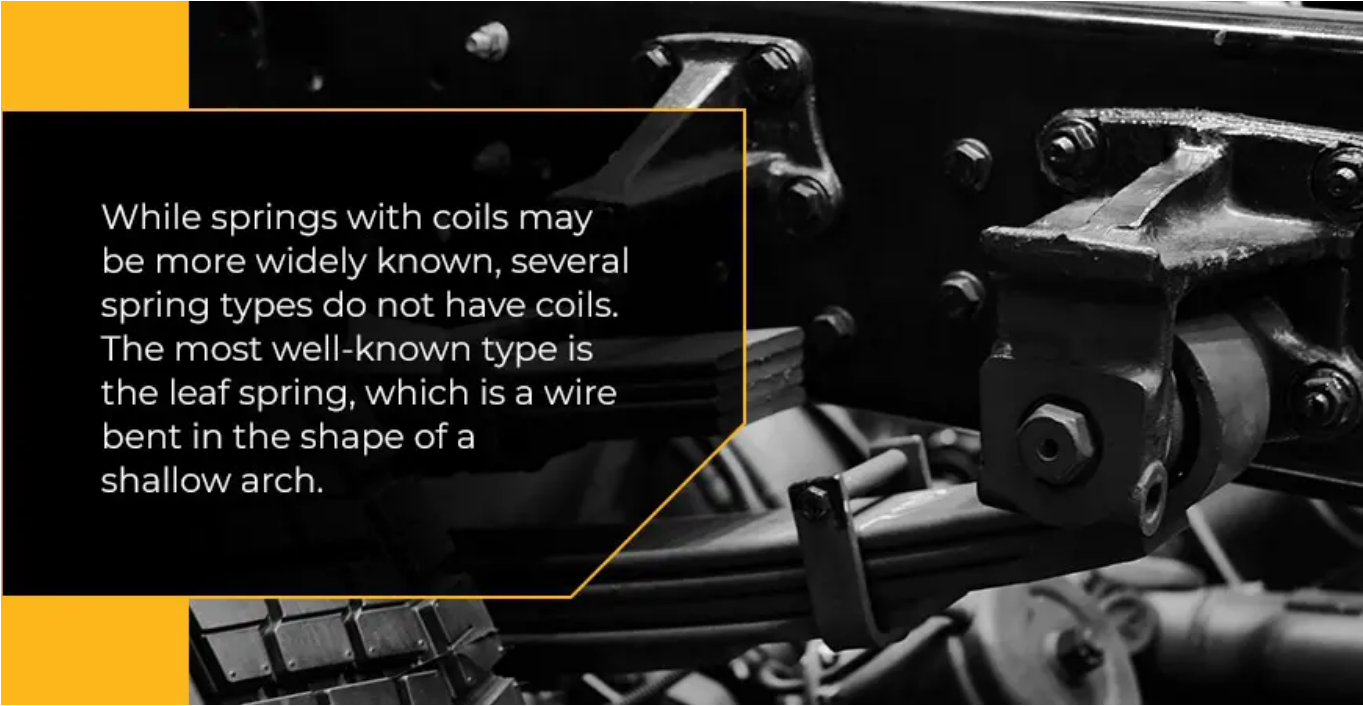
As the plate moves, the ends of the spring make contact with the grinding wheels, grinding down the ends so the end surfaces are perpendicular to the sides of the spring. Once this is done, the spring dish releases the spring into a receiving box.

4. COATING AND FINISHING

As a final touch, springs are usually finished with some type of coating, plating or finishing process. In finishing processes, the spring's surface undergoes additional steps to help combat erosion, lend new properties to the spring or simply improve the spring's overall appearance. Some examples of common finishing processes include the following:

- **Shot peening:** Shot peening is a finish applied to cold-worked springs. In this process, spherical shots are shot at the wire, resulting in compression stress and forming layers of compression dimples. As a result, the material's surface hardens, making it more resistant to fatigue, corrosion and cracking.
- **Plating:** Plating occurs when a thin layer of metal is applied to the surface of the spring or wire form. This is usually accomplished through an electroplating process where chemicals and electrical currents bond the plating metal to the surface of the spring wire. When complete, platings can provide improved corrosion resistance and strength. Platings may also improve the spring's physical or aesthetic properties. For example, copper and gold platings lend improved electrical conductivity for electronic and power applications, while nickel and cadmium platings provide a chrome finish.
- **Powder coating:** Powder coating is another option for wire spring finishes. Powder coatings are usually applied to hot-drawn springs and help prevent rust from forming on the spring's surface. Coatings may also come in a range of colors for aesthetics.

Finishes add a final level of functionality to springs, lending new properties or simply preserving the spring's longevity for the final users.



While springs with coils may be more widely known, several spring types do not have coils. The most well-known type is the leaf spring, which is a wire bent in the shape of a shallow arch.

Variations in Spring Manufacturing

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on the type of spring being created. Springs may be made with or without coils, and the presence of a coil and the spring's use will determine the types of manufacturing processes involved.

Springs with coils, also known as coil or helical springs, are what people typically think of as springs. These go through the spring winding process, usually a wire coiling or wire forming machine, resulting in a helical shape. There are several sub-types of coil springs, resulting in variations in the helical spring manufacturing process. These variations include the following:

- **Extension springs:** An extension spring is a type of coiled spring with coils that touch each other. As force is applied to stretch the spring, these coils separate, but the spring provides a return force against the force stretching the spring. Extension springs are formed primarily using a wire coiling machine but may also go through a wire forming machine, especially if it features a loop-end configuration. Alternatively, extension springs may be ground down at the ends.
- **Compression springs:** Unlike extension springs with coils that touch one another at rest, compression springs have coils that are apart at rest and squeeze together as force is applied to them. These types of springs push back against an applied force. The compression spring manufacturing process primarily utilizes a spring coiling machine, though a spring former may be used in certain cases.
- **Torsion springs:** A torsion spring is a uniquely shaped spring, with two ends extending from a coil. As force is applied to the ends, the coil twists into a tighter spiral and pushes back against the applied force. Common examples include the springs found in utility trailers or truck doors. Like extension springs, the torsion spring manufacturing process usually includes coiling or forming machines.

CUSTOM SPRING MANUFACTURING PROCESS

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Custom Spring Manufacturing Process

The spring manufacturing process will vary based on the type of spring involved, but it may also vary in cases of custom spring designs. Custom spring designs are often needed in unique manufacturing applications where a specific spring shape, material and finish is required that falls outside normal specifications. In these cases, clients work closely with coil spring manufacturers to develop, design and manufacture the spring in question.

In addition to the above spring types, spring manufacturers may also create specialty springs, like:

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- **Tapered springs:** In a tapered spring, the diameter of the coil decreases from one end to the other, creating a tapered shape. This compression spring works like others of its kind, but due to its shape, it is more stable on the lateral plane compared to the standard cylindrical compression spring.
- **Conical springs:** Conical springs are another type of compression spring with a cone shape. This conical shape allows the spring to have a reduced height compared to cylindrical compression springs.
- **Hourglass springs:** Hourglass compression springs are another type of compression spring with a unique shape. In an hourglass spring, the spring's center has a narrower diameter than the ends. The concave shape makes it easier to center the spring and enables a lower solid height, like the conical spring.

In a custom spring manufacturing process, the client will work with their custom spring manufacturer by providing them with designs. From there, the manufacturer may produce prototypes for testing, which the client can then use to tweak their designs to meet the application's needs. Once the design is finalized, the spring manufacturer can take the final design and do a production run of the spring.

What Are Springs Made Of?

Now that we've covered how springs are made, it's time to answer another commonly asked question about springs. What is a spring made of?

Springs are made of different types of metals configured into round wires. The specific types of metals are separated into three primary categories — high carbon, steel alloys and stainless steel:

- **High carbon:** High carbon spring materials are some of the most common due to their relative inexpensiveness and versatility. High carbon wire types include music wire and hard drawn wire. Music wire is often used in tools, while hard drawn wire is often used in commercial products. High carbon wire does not usually do well in high-temperature and corrosive environments, however.
- **Steel alloys:** Steel alloys are another common choice for springs and include materials like chrome silicon, which is often used in large springs. While more accepting of high temperatures, these materials are still prone to corrosion.
- **Stainless steel:** Stainless steel is the third most common type of wire for metal springs, primarily favored for its resistance to corrosion. Stainless steel comes in many varieties, all with different levels of elasticity and hardness. Stainless steel springs are often found in devices used for medical purposes or outdoor applications.

This leads to the question of what is the best material for spring manufacturing? That depends entirely on the application. The best material for a spring application will depend on several factors, including the material's physical properties and cost.

While metals are the most common materials to use for springs, certain applications may use non-metallic substances. Certain types of springs, such as cylindrical non-coil springs, may be made with rubber or urethane, while ceramic has been developed for coiled springs in high-temperature applications. These are all highly specialized uses, however, so most springs used in machines today are still made with metals.

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Springs are one of the simplest machines, but they play a huge role in the modern world, with plenty of variations for any type of application. It’s fascinating to know how these devices are made, as well as how different the processes can be depending on the type of spring someone is looking to make. If you’re searching for a manufacturer for your own unique spring design, IDC is here to help.

IDC Spring has extensive expertise and resources in spring manufacturing, allowing us to design and build mechanical springs for a range of industries and applications. From automotive and agriculture applications to industrial manufacturing and telecommunications, IDC can meet your needs.

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