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METHOD OF MAKING A PLASTIC SPRING

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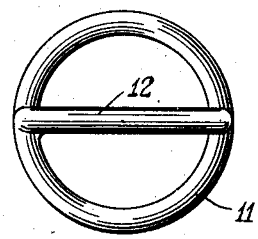

Fig. 2.

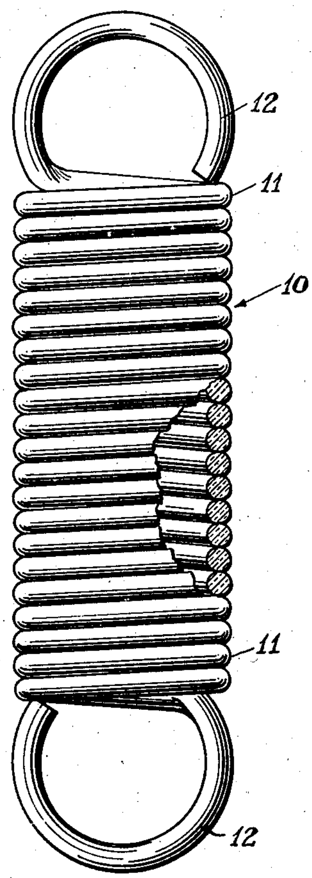

Fig. 1.

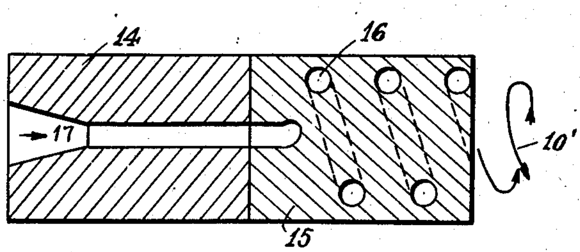

Fig. 3.

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METHOD OF MAKING PLASTIC SPRINGS

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4 Claims. (Cl. 18—47.5)

This invention relates to a method of making plastic springs and has as its main object the provision of an economical, efficient and practical helical or spiral spring made of plastic material and offering a good substitute for the conventional metal spring.

Heretofore, it has been customary to construct spiral springs out of metal. However, such material is costly and particularly at the present time there is a great scarcity of metal due to the restrictions placed on the use thereof by the United States Government, because of the present demand for metal needed for the War effort.

It has been found that by making a spiral spring out of either thermoplastic or thermosetting material an instrumentality is provided which has sufficient resiliency such that when stretched, it will return to its original spiral form.

The above and other objects and advantages of the invention will be apparent from the following disclosure thereof, taken together with the annexed drawing which illustrates a certain form of embodiment thereof; which form is shown for the purpose of illustrating the invention, since the same has been found in practice to give satisfactory and reliable results.

In the drawing:

Fig. 1 is a view in elevation, partly in section, illustrating a spiral spring made in accordance with the invention; and

Fig. 2 is a top plan view thereof; and

Fig. 3 is a diagrammatic sectional view of extrusion dies for carrying out a mode of the invention.

Referring now more particularly to the drawing, there is disclosed a spring indicated generally by the numeral 10 comprising a plurality of spirals or helixes 11 and terminating in the end loops 12, at an angle with relation to the spirals 11.

According to this invention, the spiral spring may be fabricated from plastic composition or from suitable tubular or rod plastic stock, which may be of any suitable cross-sectional shape or form. The material preferably employed is one having thermoplastic characteristics, such as, for example, cellulose acetate, Celluloid, polysterine, methal metacrylate or any of the plastic compositions known by the trade-marks, "Tenite"; "Plexiglas"; "Vinylite"; "Lumarith"; "Plastacele"; "Polystyrene"; "Lucite," etc.

The method of molding is preferably extrusion or injection; although compression or flash methods may be employed.

Where the spiral spring is made from rod or tubular stock material, the following process may be employed:

The stock material is first immersed in cold water for a period of about at least twenty-four hours, the length of time of immersion depending upon the thickness of stock used. Preferably running water is used for the immersion bath, in order to prevent the water in the bath from approaching room temperature.

Then the plastic stock material is withdrawn from the cold bath and immersed into a hot bath, the temperature of which is preferably just below boiling, for several hours, preferably from about one to three hours. The cold water immersion treatment of the plastic material prepares the latter for the hot water immersion treatment thereof. This latter treatment makes the material sufficiently flexible to be wound around a mandrel. The plastic stock material is then withdrawn from the hot bath and immediately wound into a spiral shape or form upon a suitable mandrel, the inside diameter of the spiral being determined by the diameter of the mandrel and the tension of the spirally wound device being regulated by the size of this inside diameter and the proximity of the adjacent spiral turns or loops.

It has been found economical to prepare a long length of rod in the above manner and then cut the same into predetermined lengths after which the end loops 12 are formed. These spirally-formed predetermined lengths of material are immediately immersed in a cold water bath, the shock thereof hardening and otherwise returning the material to substantially its original condition. It is understood that any other suitable liquid may be substituted for water.

An economical method of making a spiral spring would be by injection molding, where the male and female plates are provided with complementary grooves, which together form the cavity or matrix for producing a finished product, and then the plastic composition is injected into the grooves in a conventional manner. No further steps or operations are required other than separating the plates and withdrawing the finished and completed spiral spring.

In applying the extrusion method of producing the spiral spring, the plastic material is formed into a rod in the usual manner as by being extruded through die 14 (Fig. 3). Adjacent die 14 there is arranged a transfer die 15 having a spiral cavity 16, the turns of the spiral being relatively spread apart so that the soft pliable plastic rod material coming from die 14 and projecting with-in transfer die 15 can with facility be guided by the spiral groove or cavity 16, bearing in mind that the plastic material is pushed or forced forwardly in the direction of arrow 17 by hydraulic pressure. It is preferable to preheat transfer die 16.

After the rod material is extruded from die 15 assuming the shape of cavity 16, it is cut into desired lengths and then the turns or loops are pressed together, assuming the form of the spirals or loops 11 of Fig. 2, this being easily done since the spiral-shaped rod pieces are still in soft semi-plastic pliable state; the end loops 12 are formed and the completed spring is then immersed in cold water, thereby causing the material to set and the loops or turns of the spring to be maintained in their relative positions. A spiral spring made according to the above described extrusion method will have the same characteristics as those made in accordance with the previously described methods. In Fig. 3, the numeral 10′ indicates the direction of the plastic spiral rod as it comes out of the transfer die 15.

It is understood that a plurality of spiral plastic springs either of the same size or different sizes may be simultaneously molded by providing the required number of cavities in the mold, as well known in the art.

From the foregoing it is evident that there has been herein provided, a helical spring comprising a plurality of connected loops formed of a continuous piece of plastic material, said loops being displaceable relative to each other when brought under tension.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. The method of forming a spiral spring having a plurality of turns from thermoplastic material which consists in extruding the material in a heated state through a die part having an opening of a size equal to the cross-section of the material when extruded, guiding the extruded material through a spirally-arranged cavity having a pitch between adjacent turns greater than that of the finished spring, cutting the spirally formed material into lengths each having a plurality of turns therein after the same leaves said cavity, bringing the adjacent turns of the cut spirally formed material into closer proximity to provide a spiral spring having the desired final pitch, forming end loops in each of said lengths, and placing the spirally formed material in a cool medium.

2. In a method of forming a spiral spring having a plurality of turns from thermoplastic material, steps in said method which comprise passing rod material while in a heated semi-plastic state through a spirally arranged cavity having a pitch between adjacent turns greater than that of the finished spring, cutting the spirally formed material into lengths each having a plurality of turns therein after the same leaves said cavity, bringing the adjacent turns of the spirally formed material into closer proximity to provide a spiral spring having the desired final pitch, forming end loops in each of said lengths, and placing the spirally formed material in a cool environment.

3. In a method of forming a spiral spring having a plurality of turns from plastic material, steps in said method which comprise passing rod material while in a semi-plastic state through a spirally arranged cavity having a pitch between adjacent turns greater than that of the finished spring, cutting the spirally formed material into lengths each having a plurality of turns therein after the same leaves said cavity, bringing the adjacent turns of the cut spirally formed material into closer proximity to provide a spiral spring having the desired final pitch, and hardening said spring.

4. In a method of forming a spiral spring having a plurality of turns from plastic material, steps in said method which comprise passing rod material while in a semi-plastic state through a spirally arranged cavity having a pitch between adjacent turns greater than that of the finished spring, cutting the spirally formed material into lengths each having a plurality of turns therein after the same leaves said cavity, bringing the adjacent turns of the cut spirally formed material into closer proximity to provide a spiral spring having the desired final pitch, forming end loops in each of said lengths, and hardening said spring.

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