To all whom it may concern:

Be it known that I, DANIEL K. WRIGHT, a citizen of the United States, residing at Paterson, county of Passaic, State of New Jersey, have invented certain new and useful Improvements in Methods of Shaping Filaments, of which the following is a specification.

My invention relates to the manipulation of metallic bodies in the form of wires or filaments, and more especially to the shaping or forming of metal filaments before they are mounted in incandescent lamps. In U. S. Letters Patent No. 1,013,572, granted to Ruppert W. Suman on January 2, 1912, there is described a method for producing shaped filaments of tungsten in which the wire composing the filament is wound on a form or shaping device and heated to a temperature of from 1000° to 1250° centigrade in a furnace. In this case the entire length of the filament and the form on which it is wound are heated to a uniform temperature. I have discovered, however, that if the process is carried out in such a way that the straight portions of the filament are heated to a much higher temperature than that mentioned in the patent and the bends are less highly heated the filament retains its shape much better than when all portions are brought to the same temperature as described in the patent. I am able to accomplish this result simply and economically by passing an electric current through the wire between the points where it makes contact with the form on which it is wound. By this method the operation is carried on much more quickly than by the method of the above-mentioned patent and it is not necessary to use a form composed of metal having a high fusing point as the form itself is not heated to any great extent.

My invention and the advantages thereof will be best understood by reference to the following description taken in connection with the accompanying drawing in which Figure 1 is a perspective view of a shaping device adapted for use in carrying out my invention and having a wire wound thereon; Fig. 2 is a view of a shaped filament, and Fig. 3 shows a lamp mount with the filament in place thereon.

The shaping device shown in Fig. 1 consists of a base 1 which may be of metal, or if desired, may be of suitable insulating material. This base carries near its ends two elements 2, 3 in the shape of round pins rigidly connected thereto, which may be of any suitable conducting material. These pins should have a smooth clean surface in order to provide good contact with the wire and are preferably of large cross-section in comparison with the wire. If the base is of conducting material at least one of these pins should be insulated therefrom. This may be done by an insulating fiber bushing 4 as shown.

In the production of simple sinusoidal or zigzag filaments with this shaper the wire is wound back and forth between the pins 2 and 3 in the following manner; starting from the end 6 it is first carried around the pin 3 in a clockwise direction then around the pin 2 in a counterclockwise direction, then around the pin 3 again in a clockwise direction, etc., so that when viewed from above the elongated coil of wire presents the appearance of a crossed belt or the figure 8. In practice the turns of wire are wound close together to economize space, though in the long drawing, for the sake of clearness, the turns are shown as considerably separated. The end 6 of the wire may be secured by wrapping around the cleat 7 attached to the end of the base. While for the sake of clearness the opposite end of the wire is shown as simply extending past the pin 2 a short distance this end also may be secured by wrapping around the cleat 7.

When the winding of the desired amount of wire on the shaper has been completed the pin 3 and base 1 are connected to a source of current by suitable contacts shown conventionally at 11 and a sufficient amount of current allowed to pass through the wire on the shaper to heat it to a white heat which in the case of tungsten may be a temperature of about 2000° C. This heating should be carried on in a vacuum or an atmosphere of a non-oxidizing gas to prevent oxidation of the wire. In practice I find it most con-
venient to place the shaper in a bell jar filled with a mixture of hydrogen and nitrogen known as "forming" gas. With this arrangement it will be seen that the portions of the wire which are bent around the pins will carry but a very small part of the current flowing through the straight portions and also because of their contact with the comparatively large mass of metal of the pins will not be appreciably heated. When heated in this way I find that the straight portions of the wire lose much of their original resiliency and become more flexible and that the tendency of the wire to "kink" upon its removal from the shaper is entirely eliminated. By this treatment however the bends are given a permanent set but are still so resilient that when the convolutions are removed from the pins and separated the filament readily takes and retains the form shown in Fig. 2.

The length of time required to complete this operation is very short. In most cases the desired result is accomplished by passing current through the wire for one-quarter of a second. While I have shown only a few turns of wire on the shaper it will usually be found desirable in practice to wind enough wire on the shaper at one time to provide filaments for a large number of lamps.

The shaped filament may easily be removed from the shaper and placed on the supporting frame or spider 8 as shown in Fig. 3. The distance between the pins 2 and 3 having been properly chosen for the support to be used the bends in the filament will engage the hooks of the light resilient holders 9 and the ends may be secured to the leading-in conductors 10 in any desired manner. By this means it will be at once apparent that it will be possible to provide a plurality of filaments of equal length. Each filament will be composed of sections of equal length and when mounted on the supports the tension on all sections will be equal. If desired, the filaments may be transferred directly from the shaper to the supporting frame. The product which results from the carrying out of my method is claimed in a divisional application, Serial No. 190,512, filed September 10, 1917.

While I have shown and described a method for shaping a single form of filament it will be apparent that the same method may equally well be applied to the forming of filaments of various shapes by suitable modifications in the shaping device used.

What I claim as new and desire to secure by Letters Patent of the United States, is:-

1. The method of shaping a filament, which consists in winding the wire which is to compose the filament in a coil comprising a plurality of convolutions, and passing an electric current through the coil in such a way that certain portions thereof carry a much greater current than the other portions.

2. The method of shaping a filament comprising a plurality of sections of equal length, which consists in winding the wire from which the filament is to be produced between two rigidly mounted conducting supports of large cross-sections in comparison with the wire and passing an electric current through the wire in such a way that the portions between the supports will be more strongly heated than the portions surrounding the supports.

3. The method of producing a shaped filament comprising a plurality of straight sections having bends therebetween, which consists in winding the wire from which the filament is to be produced upon a suitable form in such a way that it will comprise a plurality of straight sections of the desired length separated by bends and passing an electric current through the wire in such a way that the straight portions will carry a much greater current than the bends.

4. The method of shaping a filament, which consists in winding a plurality of turns of the wire which is to compose the filament upon two suitably spaced conducting supports and passing an electric current through the wire by using the supports as electrodes.

5. The method of shaping a filament comprising a plurality of straight sections of equal lengths separated by bends, which consists in winding the wire from which the filament is to be produced in a plurality of turns between two conducting supports and passing an electric current through the wire in such a way that the portions between the supports will be heated to a white heat while the portions surrounding the supports are not appreciably heated.

6. The method of shaping a tungsten filament, which consists in winding the wire which is to compose the filament into a coil comprising a plurality of convolutions and heating certain portions of said coil to a temperature of approximately 2000°C while maintaining other portions of the wire at substantially their normal temperature.

7. The method of shaping a tungsten filament, which consists in winding the wire from which the filament is to be produced upon a suitable shaping device in such a way that it will comprise a plurality of straight sections of the desired length separated by bends and heating the straight sections to a temperature of approximately 2000°C while maintaining the bends at substantially their normal temperature.

8. The method of treating a tungsten wire, which consists in winding it upon a suitable form in such a way that it will comprise a plurality of straight sections of uniform length separated by bends, and passing an
electric current through the wire in such a way that the straight portions will carry a much greater current than the bends.

9. The method of treating a tungsten wire, which consists in winding the wire upon a suitable form in such a way that it will comprise a plurality of straight sections of uniform length separated by bends, and heating the straight portions to a temperature of approximately 2000° C. while maintaining the bends at substantially their normal temperature.

In witness whereof, I have hereunto set my hand this 13th day of April, 1914.

DANIEL K. WRIGHT.

Witnesses:

S. N. Whitehead,
J. H. Elkins.