April 29, 1941. D. E. HENNESSY 2,240,185

METHOD OF TANGLING WIRE

Filed March 17, 1939

FIG. 1.

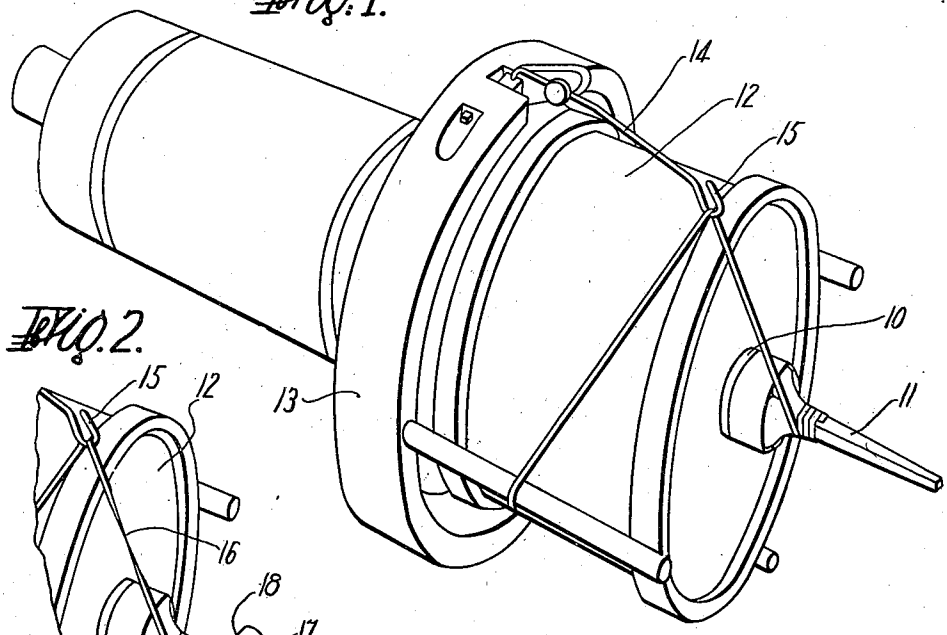


FIG. 2.

FIG. 3.

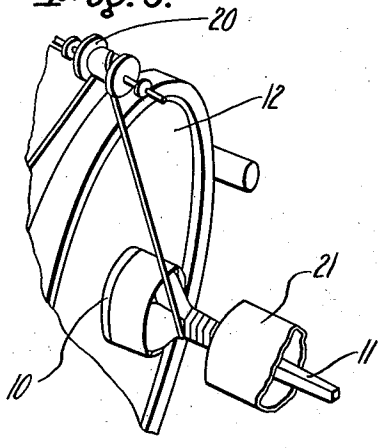


FIG. 4.



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Patented Apr. 29, 1941 2,240,185

UNITED STATES PATENT OFFICE

2,240,185

METHOD OF TANGLING WIRE

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Application March 17, 1939, Serial No. 262,508

10 Claims. (Cl. 140—71)

This invention relates to improvements in methods of producing tangled wire especially suitable for use as scrubbing or cleaning pads, air filters, sound absorbing material, and the like. The nature of the invention can best be understood from a consideration of the improved method in relation to prior methods for making helical coils out of fine flattened wire.

One method of making helical coils, such for example as are employed in making dish scrubbing pads out of fine flattened bronze wire, has been to wind the wire on a stationary mandrel by means of a so-called flyer machine. This type of machine comprises a carrier member rotating coaxially with the mandrel or needle, and carrying a guide or flyer made of light wire to avoid excessive centrifugal effects, the guide terminating in a wire loop or a small pulley. A rotatable spool, also coaxial with the mandrel, supplies the flattened wire to the guide which carries the wire in a circular path around the mandrel. The mandrel was made tapering, so that the coils formed thereon by the rotation of the guide would slide progressively along the former and off its point.

In the operation of machines of this type, it is necessary to wind the wire upon the mandrel in such a manner as to give the wire a permanent set in helical form, so that the helix slides off the mandrel in a smooth continuous coil. If a roller guide is used, this set is produced by increasing the tension on the wire so that it will be bent so tightly over the corners of the polygonal mandrel that it has substantially no tendency to unwind. The use of a wire loop instead of the roller guide, a change desirable in order to reduce the weight of this rapidly rotating part, makes it possible to reduce this tension somewhat, for the drawing of the wire across the loop of itself imparted a tendency to curl which assisted the wire to cling to the mandrel.

In accordance with the present invention, I follow somewhat the same procedure but with important differences which cause the resulting product to assume tangled rather than helical form. In fact, although the product is preferably made by winding into regular helical form on a tapering mandrel as before, the final product obtained consists of a tangled series of loops which have no vestige of helical characteristics. The detailed manner in which this is accomplished will be discussed below, but the general principles may be indicated here. I have discovered that if the helical product is formed in such a manner it has a strong tendency to unwind, instead of being set so as to be substantially without such tendency, and if the so-formed helical product is released progressively while holding the ends against rotation, the released intermediate portions will kink and tangle to form a rope-like product entirely different in appearance from the wound helix. One way of securing this tendency to unwind is to utilize the wire loop form of guide as formerly, but instead of using the curl imparted by the loop to cause the wound wire to cling to the needle the side of the wire which rubbed against the guide eye is brought outside when the wire is wound on the mandrel. This causes the tendency to curl given by the rubbing action of the guide eye to oppose the tendency to curl given by winding on the mandrel, so that the wound helix has a strong tendency to open up. As will be pointed out, other means of securing the same effect may be used.

The invention will now be described in connection with the accompanying drawing, in which:

Fig. 1 is a perspective view of one form of device by which the method may be practiced;

Fig. 2 is a perspective detail showing a modification;

Fig. 3 is a perspective detail showing a further modification; and

Fig. 4 is a view of the final product.

The general type of spindle shown in Fig. 1 is very old, and it need not be described in detail. One suitable form is shown in the Montgomery and Mason Patent 1,386,350, August 2, 1921, and reference may be made to that patent for details not shown herein. The spindle comprises a central non-rotating support 10 into which a mandrel or needle 11 is threaded. Free for rotation around the support under the influence of a tensioning brake (not herein shown) is a spool 12 on which the wire is supplied. Also rotatable around the support is a positively driven member 13 which carries a light wire flyer 14 terminating in a loop 15. The member 13 carries the wire around the mandrel in a direction which, as shown in the drawing, is clockwise when viewed from the end of the mandrel. In the form of the invention shown in Fig. 1, the wire passes over the guide eye and thence to the mandrel without any twist, so that the side of the wire which rubbed against the guide eye will be on the outside when the wire is wound on the mandrel. As was pointed out above, the rubbing of the wire over the eye produces in it a tendency to form a curl, and by the arrange-

ment described this tendency is opposed to that given by setting when the wire is wound on the mandrel. The result is that as soon as the wound coil is free from restraint it will tend to unwind; and if the product coming off the needle is held so that it cannot rotate as a whole, kinks will be formed which will produce the desired tangled product.

Instead of carrying the wire over the guide eye and back under as in Fig. 1, it is possible to carry it under and back over as in Fig. 2. It will be observed that in this case the side of the wire rubbed against the guide eye is opposed to that which rubbed against the guide eye in Fig. 1, and in order to bring the rubbed side outermost it is necesary to introduce a half turn into the wire between the guide eye and the mandrel as shown at 16. The product will be practically equivalent, although the arrangement of Fig. 1 is generally preferable as the wire seems to have less tendency to break at high speed and the tangled product is slightly tighter in texture.

Fig. 2 shows a further change from the arrangement of Fig. 1 in that the needle 17, instead of being square in cross section like the needle 11 of Fig. 1, is made round. For some purposes the sharp bends introduced into the wire by bending around the square mandrel may be desirable, as in some forms of scouring devices. For other purposes it may be preferable to have no sharp bends in the product, and in such a case a round mandrel is used. When the mandrel is square it is not necessary to provide means for holding the wire in place upon it, for the square corners give a grip on the wire that will prevent slippage. With a round mandrel, however, the wire will simply spin around the mandrel without winding into a helix unless something is provided to hold it. A roll or pad 18 held against the side of the mandrel, preferably yieldingly, will prevent circumferential slippage, the helical coils sliding axially underneath it without difficulty. The same result will be secured by pressing against the side of the mandrel with the finger.

The roll or pad 18 also prevents the helix from springing away from the mandrel until it has been definitely formed into helical shape. It is necessary to insure the production of a uniform product that the helix be released from the mandrel at a substantially constant point. Since the helix cannot release itself until after passing the roll 18, it is apparent that the roll will determine the point of release. This point may be determined in the case of the square mandrel where no holding device is used by starting the helix off the mandrel at an intermediate point of its length rather than allowing it to continue on off the end of the mandrel.

Fig. 3 shows a further manner in which the method may be practiced which comprises the use of a guide roller 20 in place of the guide eye 15. Such a roller will put no tendency to curl into the wire, and it is necessary in this case to vary the normal operation of the device by decreasing the tension on the wire so that the setting of the coil in the mandrel will not be complete and the wire will therefore tend to unwind, imparting a tendency for the helix to rotate on its axis. This view also shows a method of guiding the tangled product which is of advantage in the quality of the product produced. A tube 21 is placed around the mandrel, so that as the helix unwinds and springs into a tangled mass it will be caught and guided by the inner surface of the tube. This reduces the tendency to form a product with tangled masses separated by untangled stretches of wire, which sometimes results when the product is allowed to come off the needle by gravity. Whether the tube be used or not, it is desirable to have some support for the product as it leaves the mandrel, so that the weight of the mass hanging from the mandrel will not tend to straighten the wire out. The tube, however, has the advantage that the product is confined and made to assume a rope-like form which is convenient for packing in containers as in the manufacture of air filters or sound absorbing devices. It obviously can be used with the forms shown in Figs. 1 and 2, and has been fragmentarily indicated in Fig. 2.

It will be observed that all of the modifications described operate by forming a helix which has a tendency to spin on its axis, and allowing the helix to satisfy this spinning tendency while the ends of the helix are so held as to make it impossible for the helix to spin as a whole. The resulting kinking of the intermediate part of the helix, which is released progressively, causes the formation of a tangled product which may be caused to assume a rope-like form by confining it as in a tube. While several forms of apparatus have been shown as capable of use in carrying out the method, it will be apparent that the method is independent of them and that it might be carried out by other devices.

I claim:

1. A method of tangling wire which comprises forming a helical coil with the wire under a stress having a tendency to cause the helix to untwist, and progressively releasing the stressed helix for local rotation while holding the released product against rotation as a whole.

2. A method of tangling wire which comprises winding a wire into helical form upon a tapering mandrel with the wire under an internal stress tending to cause untwisting of the helix, and conducting the wire away from the mandrel while holding the delivered product as a whole against rotation, and releasing a portion of the product adjacent the mandrel for local untwisting as it passes off the mandrel.

3. A method of tangling wire which comprises winding a wire into helical form upon a tapering mandrel with the wire under an internal stress tending to cause untwisting of the helix, and conducting the wire away from the mandrel while holding the delivered product as a whole against rotation, and releasing a portion of the product adjacent the mandrel for local untwisting as it passes off the mandrel, the rate at which the wire is conducted away being substantially no greater than the rate at which the kinked product tends of itself to leave the mandrel.

4. A method of tangling wire which comprises passing a flattened wire over a curling edge under tension, winding the wire upon a mandrel with the side of the wire which was in contact with the curling edge out of contact with the mandrel when the wire is wound, and conducting the wire away from the mandrel while holding the delivered product as a whole against rotation, and releasing a portion of the product adjacent the mandrel for local untwisting as it passes off the mandrel, the rate at which the wire is conducted away being substantially no greater than the rate at which the kinked product tends of itself to leave the mandrel.

5. A method of tangling wire which comprises winding wire into helical form upon a non-rotating tapering mandrel under an internal stress having a tendency to cause unwinding of the helix, releasing the wound stressed helix from the mandrel, and confining the released product by contact with a non-rotating surface spaced radially from the mandrel.

6. A method of tangling wire which comprises winding wire into helical form upon a non-rotating tapering mandrel under an internal stress having a tendency to cause unwinding of the helix, holding the helix against rotation on the mandrel while permitting it to slide lengthwise of the mandrel, and releasing the helix from the mandrel progressively for local rotation while holding the previously delivered product against rotation as a whole.

7. A method of tangling wire which comprises winding wire into helical form upon a non-rotating tapering mandrel under an internal stress having a tendency to cause unwinding of the helix, holding the helix against rotation on the mandrel while permitting it to slide lengthwise of the mandrel, releasing the wound stressed helix from the mandrel, and confining the released product by contact with a non-rotating surface spaced radially from the mandrel.

8. A method of tangling wire which comprises passing a flattened wire over a curling edge under tension, winding the wire upon a mandrel with the side of the wire which was in contact with the curling edge out of contact with the mandrel when the wire is wound, thereby creating in the wire an internal stress having a tendency to cause unwinding of the helix, holding the helix against rotation on the mandrel while permitting it to slide lengthwise of the mandrel, releasing the wound stressed helix from the mandrel, and confining the released product by contact with a non-rotating surface spaced radially from the mandrel.

9. A method of making tangled strand material which comprises rubbing the strand while under tension over a curling edge, winding the strand in helical form with the rubbed side outermost, and releasing the helical product progressively for local untwisting to permit it to tangle.

10. A method of making tangled strand material which comprises rotating a guide eye around a stationary tapered mandrel, delivering the strand to the guide eye under tension and directing it from the eye to the mandrel with that side of the strand which was against the eye on the outside as the strand is wound around the mandrel, and restraining the material delivered from the mandrel at a point spaced from the mandrel to prevent its free bodily rotation while permitting kinking of the product as delivered.

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