May 25, 1965 A. G. PFUND 3,185,185

WIRE SHAPING APPARATUS

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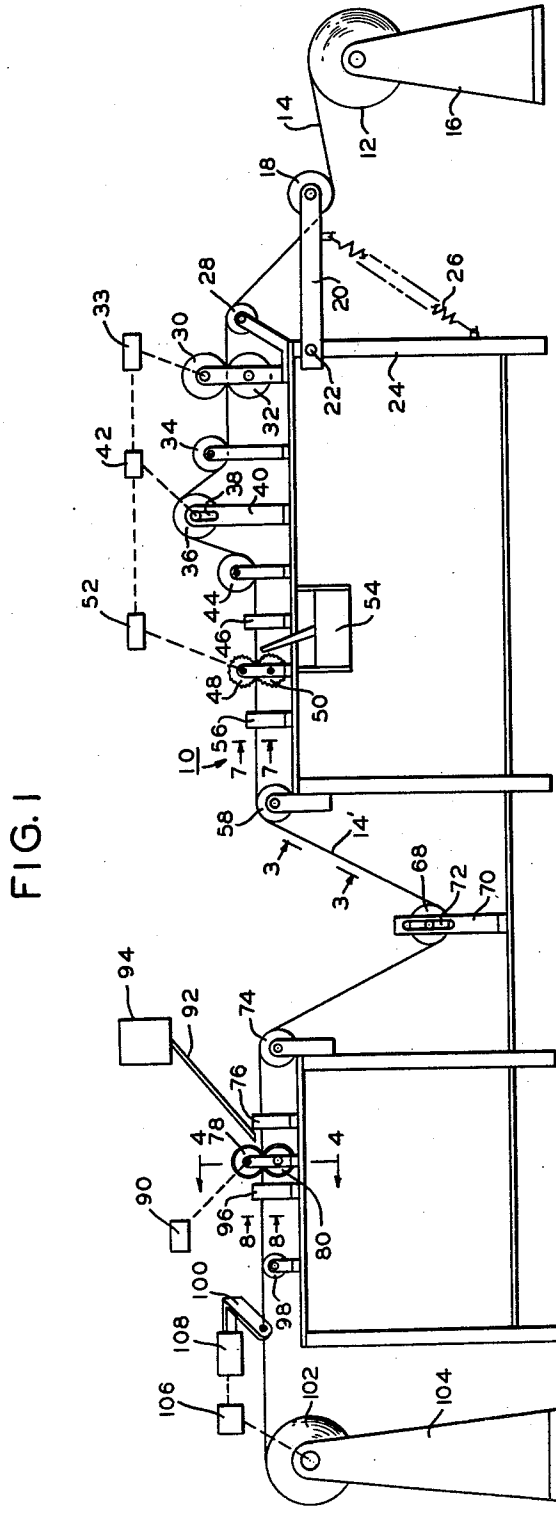

FIG. 1

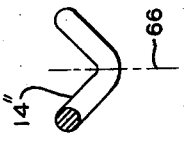

FIG. 8

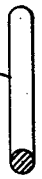

FIG. 7

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FIG. 2

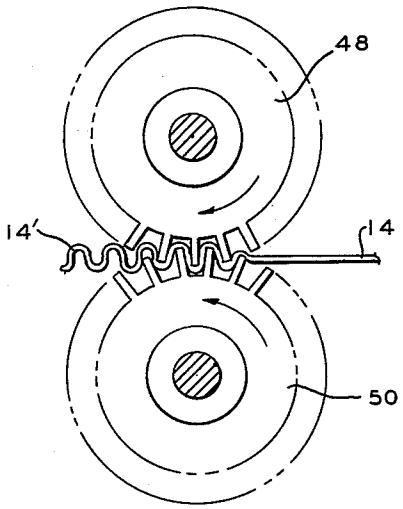


FIG. 3

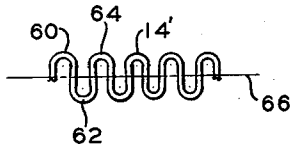


FIG. 4

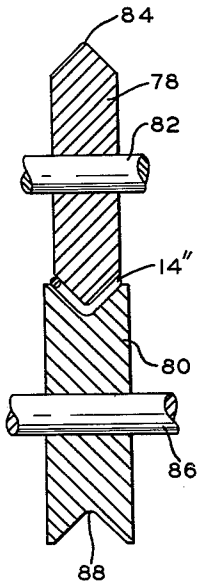


FIG. 5

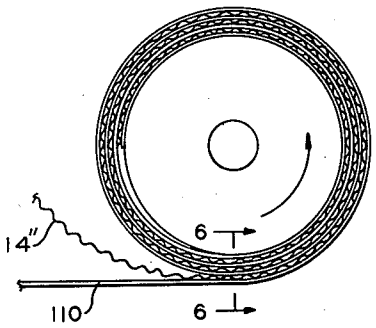
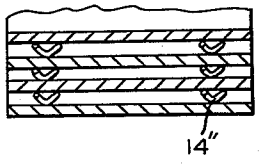


FIG. 6



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3,185,185

WIRE SHAPING APPARATUS

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2 Claims. (Cl. 140—105)

This invention relates to wire shaping apparatus, and more particularly to an apparatus for continuously bending wire into a planar sinusoidal shape and then shaping the thus deformed wire so as to have a V-shape in transverse cross-section.

One of the major changes in the steel industry is in annealing processes wherein coils of sheet steel are annealed in an inert atmosphere. In order to obtain the desired result, the various layers of sheet steel in a coil must be in contact with the inert atmosphere. Thus, a spacer must be provided so as to maintain the various layers of a coil spaced from one another. The product of the present invention has substantially revolutionized the annealing processes used heretofore.

The product of the present invention is a sinusoidally shaped wire which is bent along its longitudinal axis intermediate the loops of the sinusoidal shape so that the wire is V-shaped in transverse cross-section. In this manner, the wire product of the present invention has sufficient strength so as to maintain the various layers of the coil spaced from one another and yet provides only point contact. Thus, substantially the entire surface of each layer of a coil will be exposed to the inert atmosphere during the annealing process.

It is an object of the present invention to provide a novel apparatus for shaping wire.

It is another object of the present invention to provide an apparatus which sinusoidally shapes wire and then bends the same so that the resultant structure is V-shaped in transverse cross-section.

It is another object of the present invention to provide a novel wire shaping apparatus having controls for stopping the same in the absence of a supply of wire.

Other objects will appear hereinafter.

For the purpose of illustrating the invention there is shown in the drawings forms which are presently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalities shown.

FIGURE 1 is a schematic elevational view of the apparatus of the present invention.

FIGURE 2 is an enlarged sectional view of the mechanism for sinusoidally shaping the wire.

FIGURE 3 is a view of the sinusoidally shaped wire taken along lines 3—3 in FIGURE 1.

FIGURE 4 is an enlarged sectional view taken along lines 4—4 in FIGURE 1.

FIGURE 5 is a top plan view of a coil of sheet steel disclosing the manner in which the wire spacer produced by the apparatus of the present invention is used.

FIGURE 6 is a transverse sectional view taken along lines 6—6 in FIGURE 5.

FIGURE 7 is a sectional view taken along lines 7—7 in FIGURE 1.

FIGURE 8 is a sectional view taken along lines 8—8 in FIGURE 1.

Referring to the drawing in detail, wherein like numerals indicate like elements, there is shown in FIGURE 1 the wire shaping apparatus 10 of the present invention.

The wire shaping apparatus 10 comprises a spool 12 of wire 14 rotatably mounted on a standard 16. A wire 14 is uniform in cross-section, and is preferably circular in transverse cross-section. The wire 14 extends from the spool 12 beneath a pivotably mounted tension roller 18.

The roller 18 is rotatably mounted on a pivotable arm 20. The arm 20 is pivotably mounted at a pin 22 on a frame 24. A spring 26 has one end connected to the arm 20 and another end connected to the frame 24. The spring 26 tends to pivot the arm 20 in a clockwise direction in FIGURE 1 so as to maintain the wire 14 taut.

The wire 14 extends from the roller 18 around the guide roller 28. The guide roller 28 is rotatably mounted on a bracket which is fixedly secured to the frame 24. From the guide roller 28, the wire 14 extends between a pair of drive rollers 30 and 32. The drive rollers 30 and 32 are rotatably mounted on a bracket which is fixed to the frame 24. A motor 33 is provided for driving the rollers 30 and 32. The drive rollers 30 and 32 provide the means for unwinding the wire 14 from the spool 12 and feeding the same to the mechanisms to be described hereinafter.

From the drive rollers 30 and 32, the wire 14 is fed beneath a guide roller 34 and around a control roller 36. The control roller 36 is rotatably mounted on a shaft which is reciprocally mounted within a slot 38 on a bracket 40. The bracket 40 is fixedly secured to the frame 24. The roller 36 is biased to the position shown in FIGURE 1 by means of a spring (not shown). In the position of the roller shown in FIGURE 1, said roller operates a microswitch 42 which is capable of stopping the mechanisms of the apparatus 10 of the present invention. The roller 36 is biased by the tension of the wire 14 against the action of the spring thereby preventing the roller 36 from actuating the microswitch 42. The purpose for the control roller 36 will be made clear hereinafter.

The wire 14 passes from the roller 36 beneath a rotatably mounted guide roller 44 and then through a fixed guide 46. From the fixed guide 46, the wire 14 passes through a mechanism for sinusoidally shaping the wire 14. Any one of a plurality of mechanisms for sinusoidally shaping the wire 14 may be utilized.

The mechanism for sinusoidally shaping the wire 14 comprises a pair of rotatably mounted meshed gears 48 and 50. As shown more clearly in FIGURE 2, the meshed gears 48 and 50 shape the wire 14 thereby providing a sinusoidally shaped wire 14'. The gears 48 and 50 are driven by a motor 52 which is connected to the microswitch 42. A supply of coolant 54 is fixedly secured to the frame 24 with a nozzle extending toward the meshed gears 48 and 50.

As shown more clearly in FIGURE 2, the sinusoidally shaped wire 14' lies in a plane which is perpendicular to the longitudinal axes of the gears 48 and 50. Therefore, the sinusoidally shaped wire 14' extends through a fixed guide 56 which rotates the sinusoidally shaped wire 14' so that it lies in a horizontal plane parallel to the longitudinal axes of the gears 48 and 50.

The sinusoidally shaped wire 14' extends from the guide 56 over a rotatably mounted guide roller 58.

The shape of the wire 14' is shown more clearly in FIGURE 3. As shown in FIGURE 3, the wire 14' is sinusoidally shaped so as to have spaced peaks 60, 62, and 64 on alternate sides of the longitudinal axis 66.

From the guide roller 58, the wire 14' extends downwardly around a reciprocable tension roller 68. The roller 68 is rotatably mounted on a shaft reciprocably mounted within a slot 72 on a fixed bracket 70. A variety of means for maintaining tension in the wire 14' capable of being substituted for the roller 68 will suggest themselves to those skilled in the art. For example, the wire 14' may extend through an annular weight.

From the roller 68, the wire 14' extends over a rotatably mounted guide roller 74 and then through a fixed guide 76. From the fixed guide 76, the wire 14' extends between a pair of rotatably mounted mating dies which bend the sinusoidally shaped wire 14 along its longitudinal

axis 66 thereby providing a sinusoidally shaped wire 14" which is V-shaped in transverse cross-section.

As shown more clearly in FIGURE 4, the mating dies for bending the wire 14' include a pair of roller dies 78 and 80. The roller die 78 is fixedly secured to a rotatably mounted shaft 82. The roller die 78 is provided with a V-shaped outer peripheral surface with the apex 84 being the point of largest diameter on said roller die 78.

The roller die 80 is fixedly secured to a rotatably mounted shaft 86. The roller die 80 is provided with a V-shaped outer peripheral surface with the apex 88 being the point of smallest diameter on said roller die 80. As shown more clearly in FIGURE 4, the roller dies 78 and 80 are disposed one above the other with the apexes 84 and 88 juxtaposed and spaced from one another by a distance substantially equal to the diameter of the wire 14. As the wire 14' passes between the dies 78 and 80, it is bent along its longitudinal axis 66 thereby providing a sinusoidally shaped wire 14" which is V-shaped in transverse cross-section.

The shafts 82 and 86 are rotatably driven by a motor 90. A nozzle 92 is disposed adjacent the wire 14' between the fixed guide 76 and the roller dies 78 and 80. The nozzle 92 is connected to a supply tank 94 of cleaning solvent. Cleaning solvent from the tank 94 is continuously dripped onto the wire 14' by the nozzle 92 just before the wire 14' passes between the roller dies 78 and 80.

From the roller dies 78 and 80, the wire 14" passes through a fixed guide 96 and over a roller guide 98. From the roller guide 98, the wire 14" passes through an aperture in a traversing guide 100. The traversing guide 100 reciprocates in a direction substantially perpendicular to the longitudinal axis of the wire 14" thereby distributing the wire 14" across the full width of the wind-up spool 102. The spool 102 is rotatably mounted on a standard 104 and rotatably driven by a motor 106. The motor 106 also operates the traversing mechanism 108 which operates the traversing guide 100.

As shown more clearly in FIGURE 7, the sinusoidally shaped wire 14' lies in a single plane. As shown more clearly in FIGURE 8, the sinusoidally shaped wire 14" is V-shaped in transverse cross-section with the apex of the V lying along the longitudinal axis 66.

The apparatus 10 of the present invention operates in the following manner:

Assume that the wire 14 has been fed through the mechanism as shown in FIGURE 1, and that spool 12 contains a full supply of wire 14. Also, assume that spool 102 is empty and that the free end of the wire has been secured thereto. A switch for operating the various motors is turned to an on position. The drive rollers 30 and 32 unwind the wire 14 from the spool 12 and feed the wire to the meshed gears 48 and 60 which sinusoidally shape the wire 14. At the same time, the windup spool 102 is being rotated by the motor 106 thereby winding up the sinusoidally shaped wire 14".

The apparatus 10 continues to operate in the above manner until the spool 12 is empty. As the free end of the wire 14 approaches the control roller 36, the lack of tension enables the spring (not shown) to move the tension roller 36 to the position shown in FIGURE 1 thereby actuating the microswitch 42. Actuation of the microswitch 42 stops the motors 33 and 62 of the apparatus 10 thereby calling attention to an operator that a new spool must be substituted for the empty spool 12.

It will be noted that the motors 90 and 102 are separate from the motors 33 and 52. Accordingly, actuation of the microswitch 42 does not affect the motors 90 and 106 which continue to operate. Actuation of the microswitch 42 preferably operates an audible signal so that an operator will stop the motors 90 and 106 as the free end of the wire 14" approaches the spool 102.

A new spool is substituted for the empty spool 12 and the wire 14 is fed through the mechanism in the manner shown in FIGURE 1. It should be noted that the spool 102 is not a full spool because the wire 14" is substantially shorter than the length of the wire 14 on the spool 12. Therefore, the free ends of the wires are secured in any convenient manner. Then, the apparatus 10 is operated in the manner set forth above.

Thus, it will be seen that the apparatus 10 of the present invention operates continuously without the attention of an operator until a spool 12 is empty or a spool 102 is full. The fact that the spool 102 is full is readily ascertainable. In that event, the apparatus 10 is stopped and a substitute spool 102 is provided.

The product of the apparatus 10 is the sinusoidally shaped wire 14" which is V-shaped in transverse cross-section. The wire 14" is used in the following manner:

As shown more clearly in FIGURES 5 and 6, a sheet 110 of steel is wound in a coil before the steel is annealed. The longitudinal axis 66 of the wire 14" is parallel with the longitudinal axis of the sheet 110. The wire 14" is placed on top of the sheet 110 prior to the coiling of the sheet 110. In this manner, the wire 14" will maintain the various layers of the coil spaced from one another as shown more clearly in FIGURES 5 and 6.

Since the wire 14" is sinusoidally shaped and V-shaped in cross-section, the wire 14" will only make point contact with the various layers of the coil of sheet steel. Thus, substantially the entire surface of each layer of the coil will be in contact with the inert atmosphere during the annealing process. The sinusoidal and V-shape of the wire 14" enables the wire 14" to have sufficient strength so as to maintain the various layers of the coil spaced from one another.

The ability of the wire 14" to retain its V-shape is completely unexpected and has completely revolutionized the manner in which sheet has been annealed. A sinusoidally shaped wire as shown in FIGURE 3 can be easily straightened out by an average man. However, the V-shape of the wire 14" cannot be straightened out by an average man and requires a substantial degree of force before it can be straightened out.

The gears 48 and 50 have an O.D. of 1.140 inches and an I.D. of .765 inch. Each gear has eighteen teeth which are .05 inch wide.

As used hereinafter, the wire 14" may be referred to as a sinusoidally shaped spacer which is V-shaped in transverse cross-section and having an apex substantially equidistant from its peaks. As used hereinafter, the gears 48 and 50 may be referred to as a mechanism for bending a wire into a planar sinusoidal shape.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof and, accordingly, reference should be made to the appended claims, rather than to the foregoing specification as indicating the scope of the invention.

I claim:

1. Apparatus for making a sinusoidally shaped wire spacer which is V-shaped in transverse cross-section comprising a rotatably mounted supply of wire, a mechanism for bending said wire into a planar sinusoidal shape, a means for feeding said wire to said mechanism, a pair of mating roller dies having juxtaposed V-shaped peripheral surfaces for deforming said sinusoidally shaped wires into a sinusoidally shaped spacer which is V-shaped in transverse cross-section, means for rotatably driving one of said roller dies, a rotatably mounted wind up spool for winding up said V-shaped sinusoidal spacer, means between said dies and said mechanism for tensioning the planar sinusoidal shaped wire, and a motor means for driving said feed means, mechanism and wind up spool.

2. Apparatus for making a sinusoidally shaped wire spacer which is V-shaped in transverse cross-section comprising a rotatably mounted supply of wire, a mechanism for bending said wire into a planar sinusoidal shape, a means for feeding wire from said supply to said mechanism, mating roller dies having juxtaposed V-shaped peripheral surfaces for deforming sinusoidally shaped

wire into a sinusoidally shaped spacer which is V-shaped in transverse cross-section, means for rotating one of said dies, means between said dies and said mechanism for tensioning the planar sinusoidally shaped wire, a rotatably mounted wind up spool for winding up said V-shaped sinusoidal spacer, a traversing guide for distributing said spacer across the full width of said wind up spool, and a motor means for driving said feed means, mechanism and wind up spool.

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