April 9, 1946. E. BRUEGGER 2,398,172

WINDING OF SPIRAL FINS

Filed May 11, 1944

Fig. 1,

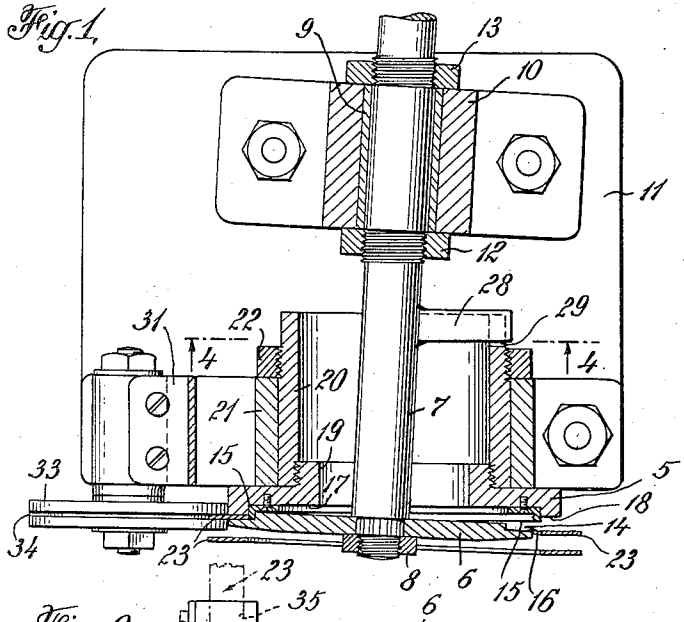


Fig. 4,

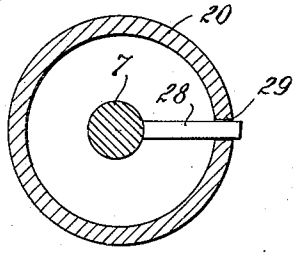


Fig. 2,

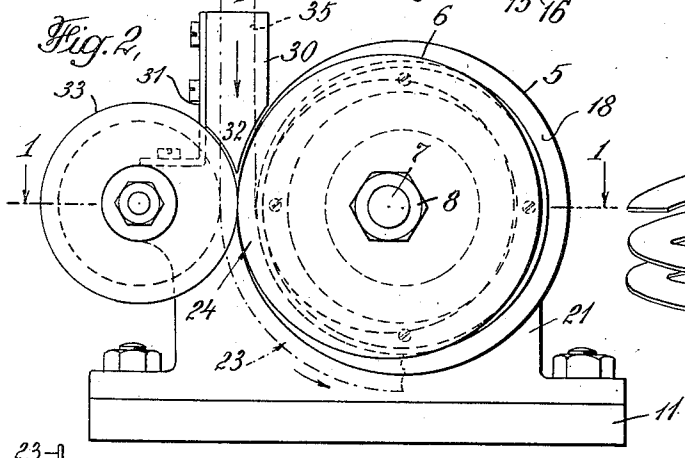


Fig. 5,

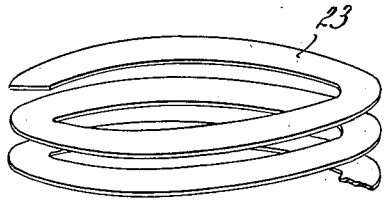
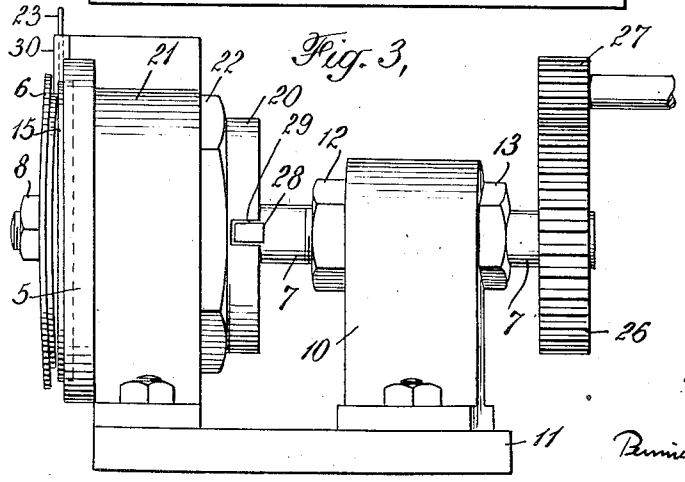


Fig. 3,



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WINDING OF SPIRAL FINS

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8 Claims. (Cl. 153—64.5)

This invention relates to the winding of a metallic strip or ribbon into a helical coil such as is employed to form the fin of a finned tube for use in heat exchangers and like apparatus.

In the fabrication of finned tubing of the type having a radially extending helical heat transferring fin thereon, it is customary and desirable to form the fin by winding a continuous straight strip or ribbon of metal into a flat helical coil which is subsequently secured along its inner edge to the surface of the tube. The winding of the ribbon into the helical coil involves bending the ribbon edgewise, and apparatus for so coiling relatively narrow ribbon of relatively heavy gauge metal is disclosed for example in United States Patent No. 1,878,233. Such apparatus is somewhat complicated, and is not entirely suitable for forming a flat helical coil from a relatively wide metallic ribbon of relatively thin gauge.

The present invention has for its object the provision of improved and simplified mechanism for continuously bending a straight metallic ribbon edgewise into a flat helical coil. Although applicable to ribbons of various size, the improved mechanism is particularly advantageous in the coiling of relatively wide ribbons of relatively thin gauge metal. Other objects of the invention include the provision of mechanism for producing flat helical ribbon coils of any length; for producing helical coils without buckling or wrinkling the ribbon; and for producing coils having uniform spacing and diameter of successive convolutions.

The invention will be described in connection with a typical embodiment thereof which is illustrated in the accompanying drawing.

In the drawing:

Fig. 1 is a sectional plan view of mechanism embodying the invention, taken along line 1—1 of Fig. 2 and viewed in the direction of the arrows;

Fig. 2 is an end elevation of the mechanism of Fig. 1;

Fig. 3 is a side elevation of the mechanism;

Fig. 4 is a sectional view taken along the line 4—4 of Fig. 1 and viewed in the direction of the arrows; and

Fig. 5 is a perspective view of a flat helical coil of edgewise wound ribbon produced by the illustrated mechanism.

Referring to the drawing, the illustrated embodiment of my improved coil winding mechanism includes generally two coil forming discs 5 and 6 of unequal diameter mounted to rotate about adjacent but angularly disposed axes with the adjacent faces of the discs at an angle to each other and in contact or substantial contact at one point of their peripheries and spaced apart elsewhere.

The outer forming disc 6 is suitably fixed to a drive shaft 7 by means such as the nut 8. The shaft 7 is journaled to rotate in a suitable bushing 9 carried in a support 10 fixed to a base 11. Axial play of the shaft 7 in the bushing 9 is prevented by any suitable means, here illustrated as the nuts 12 and 13 fixed to the shaft 7 and engaging opposite ends of the bushing 9. It should be understood that ball or roller bearings may be substituted for the journal bearing disclosed.

The outer forming disc 6 has an annular marginal recess 14 on its inner face. The marginal face 16 of the recess 14 is preferably ground and hardened. The inner forming disc 5 has a central circular recess 17 in which a ground and hardened shoulder ring 15 is secured, forming an annular marginal hardened face 18, terminating in the shoulder formed by the ring 15. The inner disc 5 has a large central opening 19 and is fixed to or formed integral with a cylindrical ring 20 which is journaled to rotate in a circular opening in the support 21 fixed to the base 11. Axial play of the ring 20 in the support 21 is prevented by engagement of the disc 5 with one end of the support and engagement of a nut 22 fixed to the ring 20 with the opposite end of the support.

The inner forming disc 5 is of larger diameter than the outer disc 6. This difference in diameter is preferably slightly more than the radial depth from the periphery of the disc 6 to the shoulder of the ring 15 as shown in Fig. 1.

The axes of rotation of the forming discs 5 and 6 are closely adjacent each other but disposed with a small angle therebetween so that the adjacent oppositely disposed faces of the discs are angularly disposed. The relative disposition of the discs 5 and 6 is such that their peripheries are aligned and their adjacent marginal end faces 16 and 18 are parallel and closely adjacent each other at and near one point, generally indicated at 24 in Fig. 2; whereas these faces are more widely spaced and the peripheries of the discs 5 and 6 are eccentric and so out of alignment elsewhere. The shoulder of the ring 15 on the inner disc 5 extends close to the face 16 of the outer disc 6 at and adjacent the point 24 but is axially spaced from that face at and adjacent a diametrically opposite point as shown in Fig. 1. The disposition of the discs is such that at their closest point, the space between the

face 16 of the disc 6 and the marginal end face 18 of the disc 5 is slightly less than the thickness or gauge of the metallic ribbon 23 to be wound, so that the ribbon is tightly gripped between these faces at and adjacent the point 24. The faces 16 and 18 are of substantially equal radial extent, as shown in Fig. 1.

Suitable means are provided for simultaneously rotating the forming discs 5 and 6 at substantially the same angular velocity. As shown, the shaft 7 carries a gear 26 engaged by a pinion 27 which may be driven by any suitable source of power. A driving finger 28, secured at one end to the shaft 7 by suitable means such as welding, extends radially from the shaft and engages a slot 29 in the rearward edge of the ring 20 (Figs. 1 and 4). With this arrangement, the discs 5 and 6 are simultaneously rotated at the same angular velocity, despite the angle between their axes.

An idler wheel 33 is rotatably mounted on a shaft journaled in the support 21 adjacent the discs 5 and 6 on an axis parallel to the rotational axis of the disc 5. The wheel 33 has a peripheral slot 34 therein of slightly greater width than the thickness of the ribbon 23 to be wound. The periphery of the idler wheel 33 contacts the periphery of the disc 5 close to but in advance of the point 24 where the discs 5 and 6 are most closely adjacent each other. The wheel 33 is substantially in contact with the periphery of the disc 6. The slot 34 in the wheel 33 is aligned with the space between the faces 18 and 16 of the discs 5 and 6, and as shown in Fig. 1 this slot together with the space between the disc faces 18 and 16 forms an opening through which the ribbon 23 passes.

A ribbon guide 30 is fixed to the support 21 by a bracket 31 and has a tapered point 32 extending between the discs 5 and 6 and the slotted idler wheel 33. The ribbon slot 35 of the guide 30 is aligned with the space between the disc faces 16 and 18 and the slot 34 of the wheel 33.

In the operation of the disclosed embodiment of my invention, a ribbon 23 of any suitable ferrous or non-ferrous metal or alloy is fed through the guide 30 and the forming discs 5 and 6 are simultaneously rotated in the direction of the arrow in Fig. 2. The ribbon 23 enters the space between the disc faces 16 and 18 at a point where these faces approach their most closely adjacent point 24. The slotted idler wheel keeps the outer portion of the ribbon 23 from buckling or wrinkling. As the ribbon 23 approaches the point 24, it is firmly pinched between the disc faces 16 and 18, and at and adjacent this point it is bent edgewise about the circular shoulder of the ring 15 of the disc 6 as shown in Fig. 2, and thereby continuously formed into a flat helical coil. The pinch of the ribbon 23 between the faces 16 and 18 causes the inner edge of the ribbon to hug the shoulder formed by the ring 15, thus avoiding any outward pressure of the outer edge of the ribbon against the bottom of the slot 34 in the wheel 33. The diameter of the shoulder on the ring 15 is the same as the desired inside diameter of the helical coil of ribbon being formed. Since the inner portion of the ribbon is tightly compressed between the disc faces 16 and 18 while the bending takes place, wrinkling of the ribbon along or adjacent its inner edge due to edgewise bending is avoided. As the ribbon 23 passes beyond the point 24, the faces 16 and 18 move out of contact therewith and the coiled ribbon finally moves over the outer peripheral edge of the outer disc 6 as it approaches a point substantially diametrically opposite the point 24, as shown in Fig. 1. The coil of ribbon thus advances axially away from the plate 6 in the form generally illustrated in Fig. 5.

I claim:

1. In mechanism for winding a metallic ribbon into a flat helical coil, in combination, a pair of circular forming members each having oppositely disposed adjacent flat end faces, one of said members having a larger diameter than the other, means for mounting said members to rotate about adjacent axes disposed at an angle to each other with their end faces in peripheral alignment and closely adjacent each other at one point of the circumference of said members and spaced more widely apart and radially displaced over the rest of the circumference thereof, means for simultaneously rotating said members, means for guiding a metallic ribbon between the end faces of said members at a point where such faces approach said closely adjacent point and a rotatable wheel having a slotted peripheral edge adjacent the peripheries of said forming members for guiding a portion of the width of such a ribbon that extends beyond the peripheries of said forming members where the ribbon enters the space between the end faces of said forming members.

2. In mechanism for winding a metallic ribbon into a flat helical coil, in combination, a pair of circular forming discs of different diameter having oppositely disposed adjacent marginal end faces, said face on the larger of said discs terminating in a circular shoulder, means for mounting said discs to rotate about closely adjacent axes disposed at a small angle to each other with their marginal end faces in peripheral alignment and closely adjacent each other at one point of the circumference of said discs and spaced more widely apart and radially displaced over the rest of the circumference thereof, means for rotating said discs in unison, means for guiding a portion of the width of a straight metallic ribbon between the marginal end faces of said discs and into edgewise contact with said circular shoulder at a point where such faces approach said closely adjacent point whereby the ribbon is gripped between said faces and bent around said shoulder as said discs rotate, and means for guiding the portion of the width of said ribbon extending beyond said marginal end faces where said ribbon enters the space between said faces.

3. In mechanism for winding a metallic ribbon into a flat helical coil, in combination, a pair of circular forming discs of different diameter having oppositely disposed adjacent marginal end faces of equal radial width, said face on the larger of said discs terminating in a circular shoulder, means for mounting said discs to rotate about closely adjacent axes disposed at a small angle to each other with their marginal end faces in peripheral alignment and closely adjacent each other at one point of the circumference of said discs and spaced more widely apart and radially displaced over the rest of the circumference thereof, means for rotating said discs in unison, means for guiding a portion of the width of a straight metallic ribbon between the marginal end faces of said discs and into edgewise contact with said circular shoulder at a point where such faces approach said closely adjacent point whereby the ribbon is gripped between

said faces and bent around said shoulder as said discs rotate, and a rotatable wheel having a slotted peripheral edge adjacent the peripheries of said discs for guiding the portion of the width of said ribbon extending beyond said marginal end faces of said discs where said ribbon enters the space between said faces.

4. In mechanism for winding a metallic ribbon into a flat helical coil, in combination, a pair of circular forming discs having oppositely disposed adjacent marginal end faces of equal radial width, said face on one of said discs terminating in a circular shoulder, means for mounting said discs to rotate about closely adjacent axes disposed at a small angle to each other with said marginal end faces closely adjacent each other and said shoulder closely adjacent the opposite face at and adjacent one point of the circumference of said discs, and said faces spaced more widely apart over the rest of the circumference thereof, means for rotating said discs in the same direction at substantially the same angular velocity, means for guiding a straight metallic ribbon between said marginal end faces of said discs and into edgewise contact with said circular shoulder at a point where said faces approach said closely adjacent point, and a rotatable wheel having a slotted peripheral edge adjacent the peripheries of said discs for guiding a portion of the width of such a ribbon which extends beyond the peripheries of said discs where the ribbon enters the space between the marginal end faces of said discs whereby the ribbon is gripped between said faces, bent around said shoulder and released from said faces as said discs rotate.

5. In mechanism for winding a metallic ribbon into a flat helical coil, in combination, a pair of circular forming discs of different diameter having oppositely disposed adjacent marginal end faces, said face on the larger of said discs terminating in a circular shoulder, means for mounting said discs to rotate about closely adjacent axes disposed at a small angle to each other with said marginal end faces in peripheral alignment and closely adjacent each other and said shoulder substantially contacting said face of said smaller disc at and adjacent one point of the circumference of said discs, and said faces spaced more widely apart and radially displaced over the rest of the circumference thereof, means for rotating said discs in unison, means for guiding a straight metallic ribbon between said marginal end faces of said discs and into edgewise contact with said circular shoulder at a point where said faces approach said closely adjacent point, and rotatable means adjacent the peripheries of said discs at said closely adjacent point for supporting a portion of the width of the ribbon that extends beyond the peripheries of said discs whereby the ribbon is gripped between said faces, bent around said shoulder and released from said faces to pass over the periphery of the smaller of said discs as said discs rotate.

6. In mechanism for winding a metallic ribbon into a flat helical coil, in combination, a rotatably mounted first forming disc having an end face and a central opening, a rotatably mounted shaft extending through the central opening of said first disc and disposed closely adjacent but at an angle to the axis of rotation of said first disc, a second forming disc fixed to said shaft adjacent said first disc and having an end face adjacent and disposed at an angle to the end face of said first disc, a driving connection between said shaft and said first disc for causing said discs to rotate in unison, and means for guiding a metallic ribbon between said end faces of said discs.

7. In mechanism for winding a metallic ribbon into a flat helical coil, in combination, a rotatably mounted first forming disc having a marginal end face and a central opening, a rotatably mounted shaft extending through the central opening of said first disc and disposed closely adjacent but at an angle to the axis of rotation of said first disc, a second forming disc of smaller diameter than said first disc fixed to said shaft adjacent said first disc and having a marginal end face adjacent and disposed at an angle to the marginal end face of said first disc, the peripheral edges of said discs being aligned substantially at the point where said marginal end faces are most closely adjacent each other, a driving connection between said shaft and said first disc for causing said discs to rotate in unison, and means for guiding a metallic ribbon between the marginal end faces of said discs adjacent the point where they are most closely adjacent each other.

8. In mechanism for winding a metallic ribbon into a flat helical coil, in combination, two forming discs of different diameter having oppositely disposed adjacent marginal end faces, said discs being disposed at a small angle to each other and being substantially peripherally aligned at the point where their marginal end faces are most closely adjacent each other, means for mounting said discs to rotate in unison about adjacent angularly disposed axes and means for guiding a metallic ribbon between the marginal end faces of said discs adjacent the point where said faces are most closely adjacent each other.

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