A method and apparatus is disclosed for the formation and production of circumferentially discontinuous thin-wall sleeves from a thin metallic strip.
METHOD AND APPARATUS FOR MAKING SLEEVES

SUMMARY OF THE INVENTION

An end of a thin metallic ribbon is passed with force between opposed forming tools arranged and designed to impart an inward curl or spiral to the ribbon end. The spirally curled sleeve is received in an adjacent concave recess, and further formed and shaped so that the leading end is deflected axially and separated inwardly from the following portion of the metal ribbon. Then, the ribbon and the formed coil both firmly held, a key is cut across the ribbon to sever the coil. The principal object of this invention is the severing of a sleeve-like coil formed on the end of a metal ribbon with ease and facility, in a confined space, rapidly, and with accuracy.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of a coil forming apparatus, portions being omitted for convenience of illustration; FIG. 2 is an enlarged end view schematically showing coil forming and cutting apparatus; FIG. 3 is a perspective view of a sleeve produced by this invention; FIGS. 4 and 5 detail the coil severing operation; FIG. 6 shows alternate coil severing means; FIG. 7 is an end view of a sleeve of FIG. 3; FIG. 8 shows a sleeve mounted for use; and FIG. 9 shows an alternate form of sleeve.

DESCRIPTION OF THE INVENTION

In the drawings is shown a preferred embodiment of the apparatus, and modifications thereof employed for carrying out the objectives of this invention and useful in practicing the novel method involved. In FIG. 1, where is shown schematically an apparatus employed in connection with the invention, on base 10 is mounted a lower pair of rolls 12, superimposed by an upper pair of rolls 14 so arranged that nips 16 are provided therebetween. The upper rolls are counter-rotating with respect to the lower rolls. The rolls are pressed tightly together, and means (not shown) is provided for driving the rolls in their respectively indicated counter-rotative direction. Mounting rolls 14 mounted in carrier 15 is toggle mechanism 80 operable between fixed pin 82 on base 10 and the pin 84 mounted in carrier 50. The toggle mechanism 80 is actuated by pressure cylinder 86 which operates to force rolls 14 to bear down more or less on a ribbon 24 disposed between rolls 14 and 16. The ribbon is advanced by the rolls in a positive manner, and with considerable force through the throat 29, past the curler nosing 34, and so that its end, upon making contact in cavity 36, is appropriately spirally curved or coiled inward as later described.

A guideway is formed between plates 20,22 adjacent the pairs of rolls for the guided passage of a metal ribbon 24, which moves between plates 20,22 into the nips 16,16, and then advances to a forming position where the essential operations of sleeve production are conducted.

The method disclosed herein results in the production of a thin wall, circumferentially discontinuous sleeve. The essential steps comprise inwardly curving the end of an advancing thin, metallic strip into a cylindrical form. The formed strip is then kerf-cut transverse the longitudinal axis of the strip and in a direction alongside the axis of the cylindrical form. While the preferable direction of the kerf-cutting of the sleeve from the strip is parallel to the axis of the cylindrical body, it will be apparent to those skilled in the art that the transverse cut may be in a direction canted or angled with regard to the axis of the body. The curving actions occurring in the formation of the body are such that when the sleeve has been severed and all restraining forces are dissipated, the leading end 25 snaps outward. When the cutting operation is performed prior to the passage of the leading end 25 past the line of cutting, the sleeve will have no overlapped portion 44 as in FIG. 7. However, for the purposes for which these sleeves are designed, it is desirable that the edges of the circumferentially discontinuous sleeve be overlapped as shown in FIG. 7. Such a sleeve in use is expandable into a true cylindrical form as, for example, about a mandrel 8 (see FIG. 8).

Referring to FIG. 2, as the ribbon 24 is advanced to the left in the drawing, it passes over former base 26 and beneath hold down shoe 28. Slight space between these elements comprises a throat 29. The base 26 may have a hardened concave ledge member 30 inserted therein and operable to receive the ribbon 24 and to curve it upward slightly as it moves forward. Overhanging the mouth of throat passage 29 is curler block 32 having an extremely hard nose 34 against which the upwardly curling ribbon 24 bears or presses as it is advanced. Block 32 reversely curves ribbon 24 and initiates the coiling action which forms the sleeve to a cylinder-like shape.

The curler block 32 may be raised and lowered with respect to the moving ribbon 24, but the position of the curler determines the degree of reverse curving of the end of the thin metallic strip and, ultimately the diameter of the formed sleeve.

As strip 24 exits from throat 29, past nose 34, and continual advancing pressure is applied by the rolls 12,14, the end of the strip spirally curves as shown in FIGS. 2 and 6. The leading end 25 in due course is curved around and comes into contact with the wall of the open-faced concave cavity 36. The shape of cavity 36 is such that its walled surface is of progressively decreasing radius as it approaches the underside of block 30. Block 30 has a tongue 38 under surface of which is spaced downwardly or separated from the upper concave surface of 31 thereof. Tongue 38 separates and deflects axially the advancing ribbon end 25 from the following portion of the ribbon. The advancing ribbon is then separated spirally as in FIG. 2, leaving space 40 to facilitate parting or cutting the formed coil from the following part of strip 24.

It will be apparent that the thicker the tongue, the greater will be the space 40. Also the tighter the concavity of surface 36, the tighter the sleeve coil is. The edges of ribbon 24 are to be understood to be held by cheek plates at each side of the forming operation. At some time, the top and bottom surfaces are securely held between the curler 34 and tongue 38.

The spirally coiled sleeve is severed from the following part of the strip transverse its longitudinal axis. It is essentially cylindrical when severed, in the manner as shown in FIG. 7. The leading end 25 is overlapped by the severed following portion 44, and the sleeve appears as shown in the end view of FIG. 7.

Severing or separation of the sleeve from the ribbon is accomplished by a kerf-cutting operation conducted transverse the longitudinal axis of the strip, and preferably parallel to the axis of the curled sleeve. A kerfing cutter 50 on tool 51 is moved as shown in FIGS. 4 and 5 in the direction transverse of the ribbon 24. Concave cutting edge 52 of cutter 50 is moved across the ribbon 24, and the sharp edges thereof remove a narrow strip of the ribbon. The removed strip tends to form curl 54 seen in FIGS. 4 and 5 in advance of the cutter 50. The cutting tip 52 moves in space 40 above the leading end 25 of the ribbon, and through the following portion of ribbon 24 as close as possible to the curler 32 and lip 38. Cutter 50 is mounted on slide block 56 which is reciprocally moved in ways 50 formed in cross head 60.

Referring to FIG. 6, the cutting or severing of the spirally formed sleeve 42 is alternately shown as accomplished by rotary metal saw 70 mounted on mandrel 72. It is to be understood that said mandrel is moved in a direction to traverse the longitudinal axis of ribbon 24. It will be observed that with tool 50 and tool 70, there is in each instance a kerf cut in the metal strip. When the sleeve 42 has been severed in the manner described, it falls out of cavity 36, whereupon a further increment of ribbon 24 is advanced to repeat the operation.

Sleeves of the type produced in accordance with this invention may be plain ended as shown in FIG. 3, or they may have a flared end 74 as shown in FIG. 9. The flaring of the sleeve is performed by a separate pressing operation.
3

The uses to which sleeves according to this invention are put forms no part of this invention. A sleeve 44 is passed, as on a mandrel 86, through a hole in metal, sized to receive the mandrel and the sleeve 44. A head 88, somewhat larger in diameter than mandrel 86, is on the end of the mandrel. The sleeve is caused to expand against the walls of the hole in which it is placed, desirable lateral working of the metal surrounding the hole, by the head on mandrel 86 being moved axially through the sleeve. When head 88 is withdrawn from sleeve 44, the sleeve collapses, and is easily removed from the hole.

What is claimed is:

1. The method of producing a thin wall, circumferentially discontinuous sleeve, comprising:
   - inwardly curving the end of a thin metallic strip into a cylindriform body and axisward deflecting the leading end portion of said strip relative the following portion;
   - kerf-cutting said strip transverse its longitudinal axis to sever the cylindriform body from the strip; said kerf-cutting being performed at a location leaving a portion of the strip in overlapping relation to the curved end of the strip.

2. The method of claim 1 in which the kerf-cutting is accomplished in a transverse direction paralleling the axis of the body.

3. The method of claim 2 in which the kerf-cutting is accomplished by the use of a parting tool.

4. Apparatus for producing a thin wall, circumferentially discontinuous sleeve, comprising:
   - means forming a throat having an outlet;
   - means for intermittently forcefully advancing a predetermined length of thin metallic strip in said throat and through said outlet;
   - means adjacent said outlet operable to pass and curl into a cylindriform body the predetermined length of strip advanced through said outlet, the predetermined length of strip advanced being such that when curled, the leading end of the strip laps a curled portion of the following strip;
   - means to separate said lapped portions by deflection axisward of the leading end; and
   - kerf-cutting means external of said cylindriform body operable to kerf and part said following strip transverse its direction of advancement.

5. Apparatus according to claim 4 in which the kerf-cutting means is operable to kerf said strip in a transverse direction parallel to the axis of the cylindriform body.

6. Apparatus according to claim 5 in which the kerf-cutting means comprises a tool operable to remove and curl a portion of said strip.

* * * *