United States Patent

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[15] **3,665,744**

[45] **May 30, 1972**

[54] METHOD AND APPARATUS FOR MAKING SLEEVES

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[22] Filed: **May 21, 1970**

[21] Appl. No.: **39,367**

[52] **U.S. Cl.** **72/129**

[51] **Int. Cl.** **B21f 11/00**

[58] **Field of Search** 72/129, 130, 131, 132; 113/7, 113/11

[56] **References Cited**

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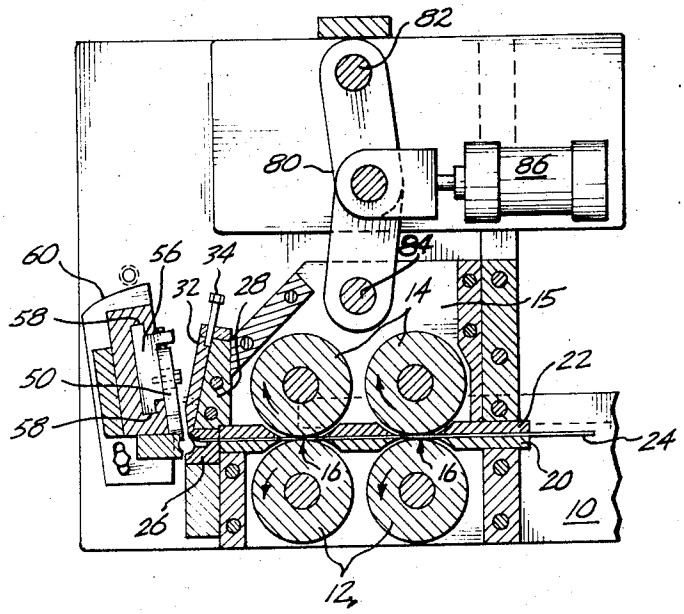
[57] **ABSTRACT**

A method and apparatus is disclosed for the formation and production of circumferentially discontinuous thin-wall sleeves from a thin metallic strip.

6 Claims, 9 Drawing Figures



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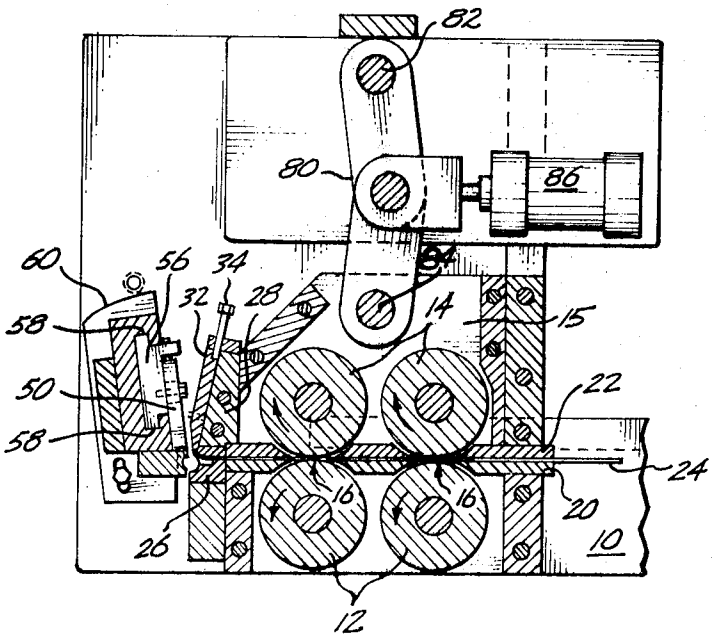

Fig. 1.

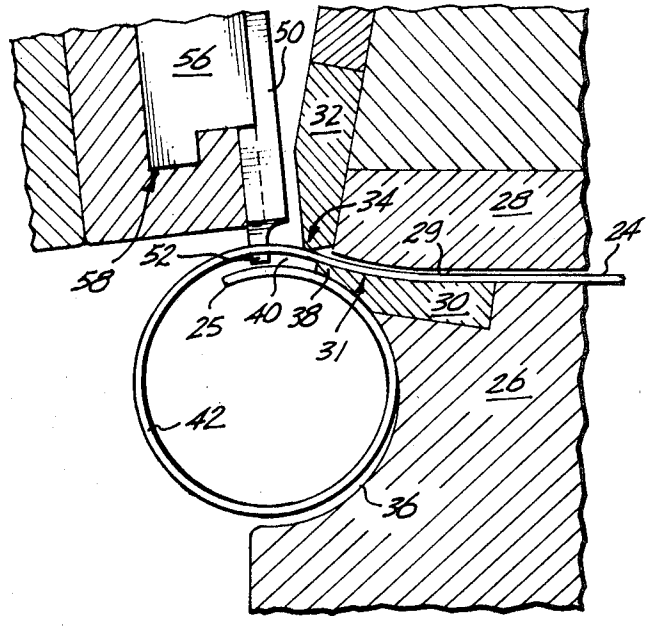

Fig. 2.

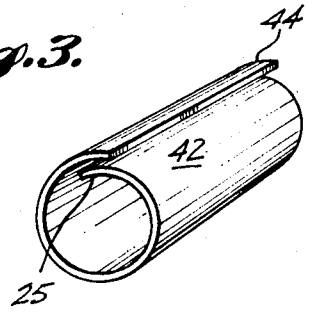

Fig. 3.

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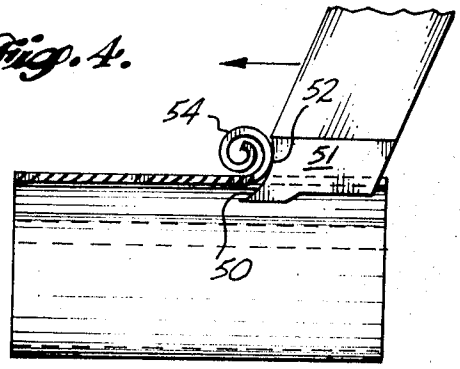
Fig. 4.



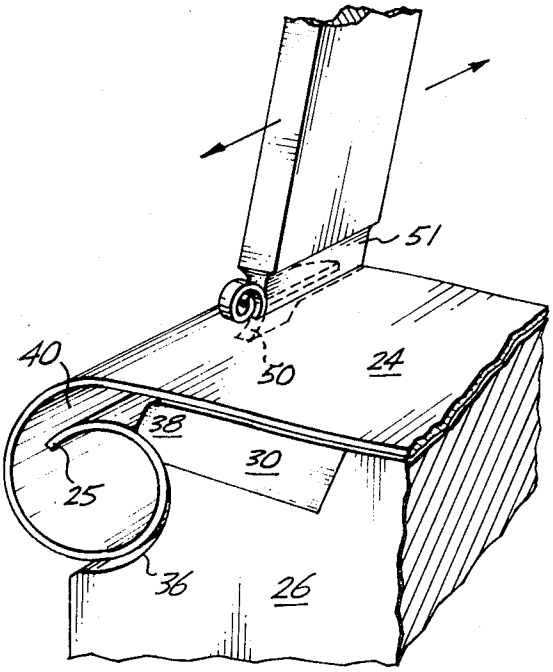


Fig. 5.

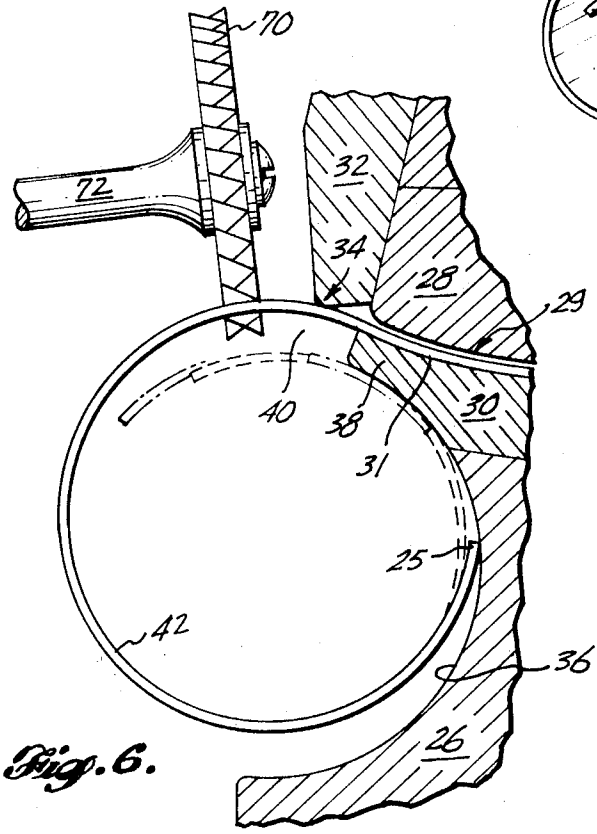


Fig. 6.

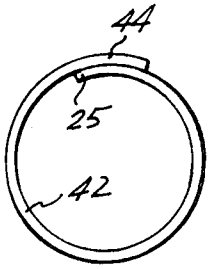


Fig. 7.

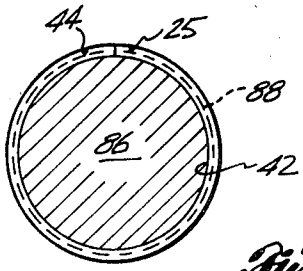


Fig. 8.

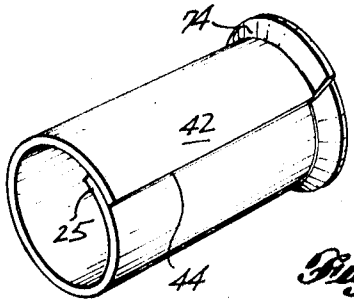


Fig. 9.

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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 axisward and separated inwardly from the following portion of the metal ribbon. Then, the ribbon and the formed coil being firmly held, a kerf 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 apparatus employed in connection with the invention, on base **10** is mounted a lower pair of rolls **12**, superposed 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. Surmounting 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 cylindriform body. The formed strip is then kerf-cut transverse the longitudinal axis of the strip and in a direction alongside the axis of the cylindriform body. While the preferable direction of the kerf-cutting of the sleeve from the strip is parallel to the axis of the cylindriform 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 occuring 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 cylindriform 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 curving 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**, the relative position of the curler determining 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 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 axisward 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 the same 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 cylindriform 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.

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, desireable 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.

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