Feb. 24, 1959 C. J. SMITH 2,874,731

WIRE FORMING APPARATUS

Filed May 24, 1954 2 Sheets-Sheet 2

Fig. 7.

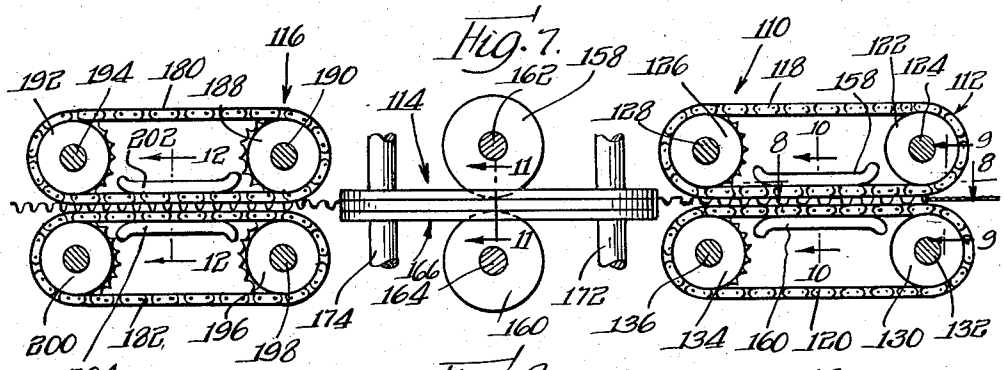


Fig. 8.

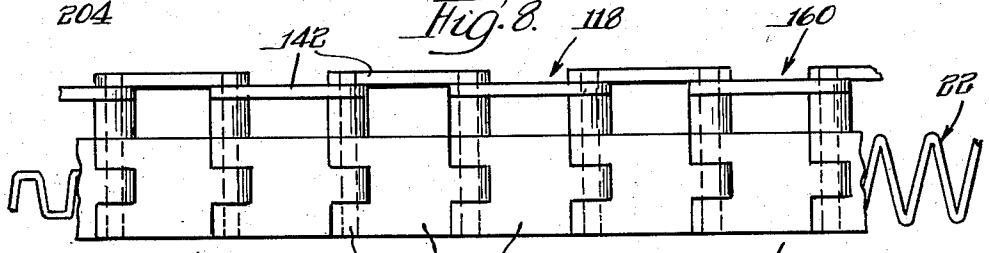


Fig. 10.

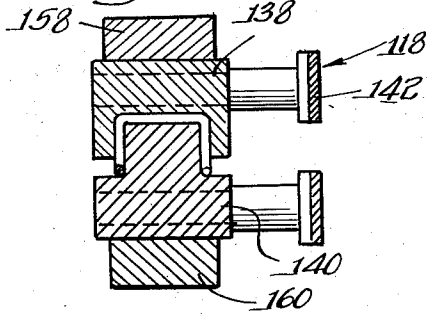


Fig. 9

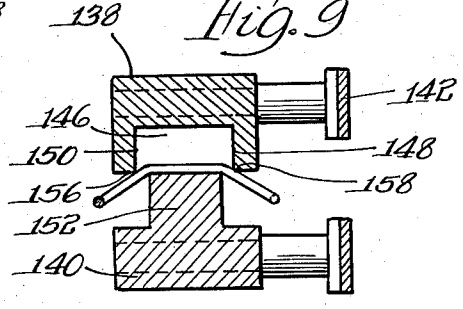


Fig. 12.

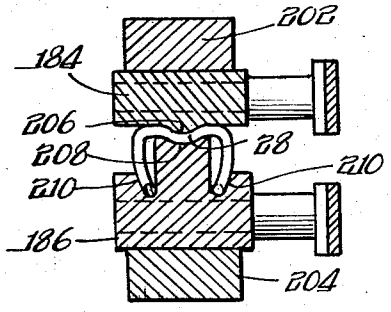
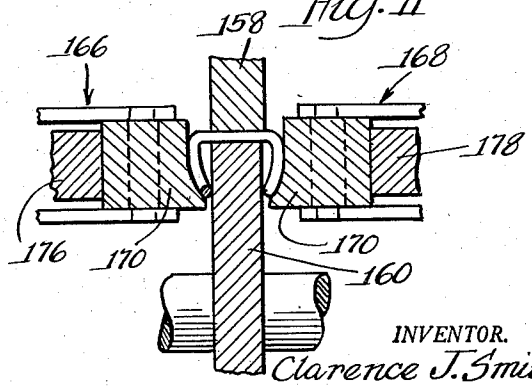


Fig. 11



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Feb. 24, 1959 C. J. SMITH 2,874,731

WIRE FORMING APPARATUS

Filed May 24, 1954 2 Sheets-Sheet 1

Fig. 1.

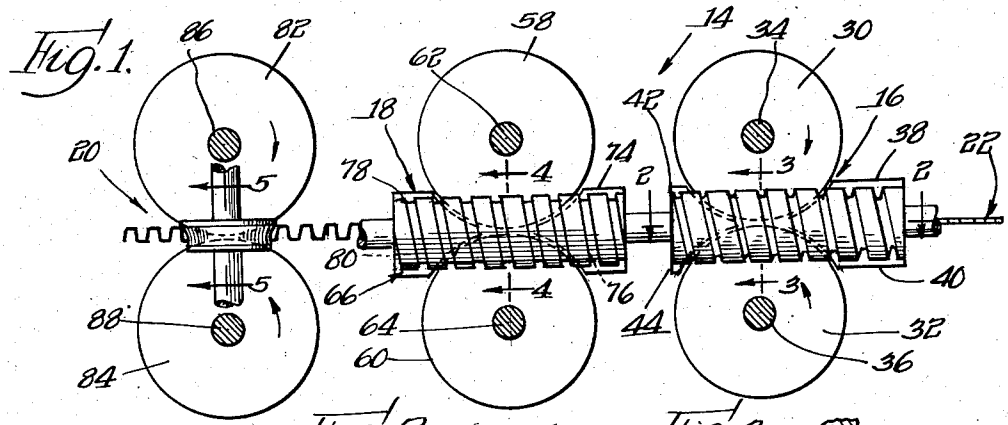


Fig. 2.

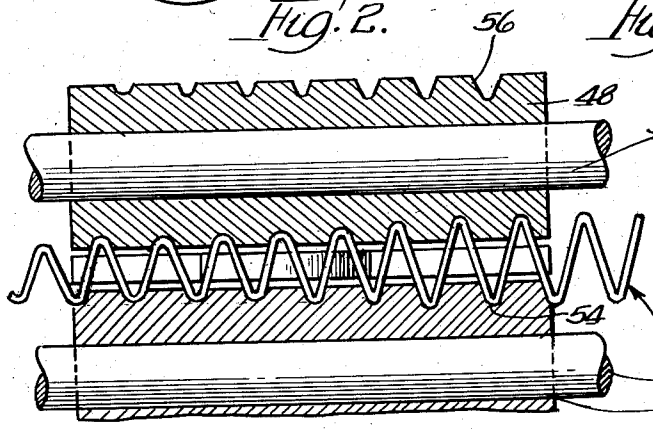


Fig. 3.

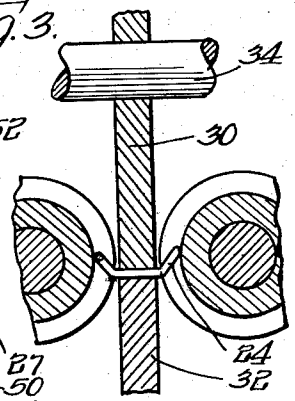


Fig. 4.

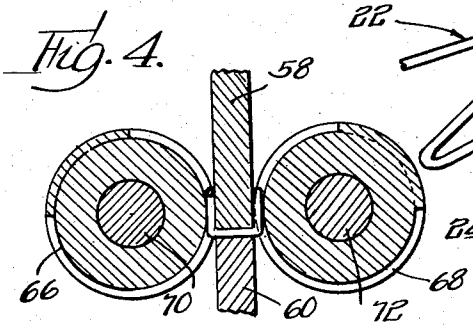


Fig. 6.

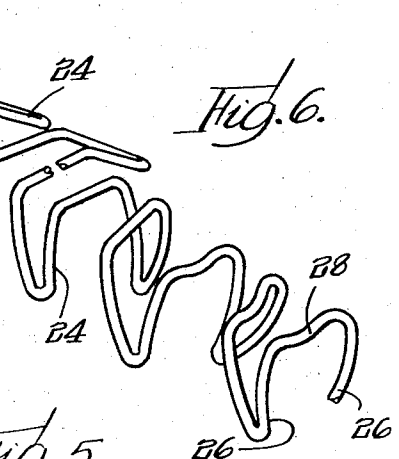
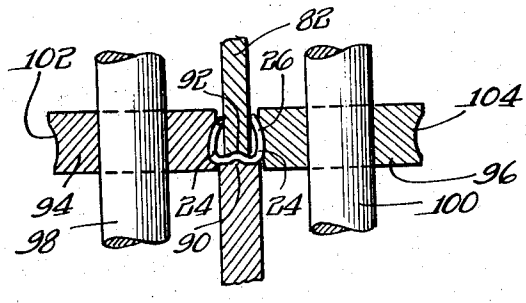


Fig. 5.



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2,874,731

WIRE FORMING APPARATUS

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Application May 24, 1954, Serial No. 431,711

5 Claims. (Cl. 140—71)

The present invention relates to a novel apparatus for forming wire articles and more particularly to a novel apparatus for making tire inserts from zigzag wire stock. While the tire insert may have various shapes, the insert disclosed more fully hereinbelow for the purpose of illustrating the present invention is formed by bending transverse sections of zigzag wire stock generally into U-shapes with the ends of the U turned inwardly. In addition, the mid-portions of the transverse wire sections which provide the closed ends of the U may be bent to provide an inwardly extending projection. However, it should be clearly understood that the specific structure of the wire insert forms no part of the present invention.

A primary object of the present invention is to provide a novel apparatus for forming tire inserts of the above described general type at an increased rate and therefore more economically.

A more specific object of the present invention is to provide a novel apparatus for forming tire inserts of the above described general type from continuously moving zigzag wire stock, whereby the inserts may be continuously and economically produced.

Still another object of the present invention is to provide a novel apparatus of the type set forth in the preceding paragraph, which apparatus is capable of positioning and retaining the zigzag wire stock so that the wire is accurately formed while continuously moving along a predetermined path of travel.

Other objects and advantages of the present invention will become apparent from the following description and the accompanying drawings wherein:

Fig. 1 is a somewhat schematic side elevational view illustrating an apparatus embodying the principles of this invention;

Fig. 2 is an enlarged cross sectional view taken along line 2—2 in Fig. 1;

Fig. 3 is an enlarged cross sectional view taken along line 3—3 in Fig. 1;

Fig. 4 is an enlarged fragmentary cross sectional view taken along line 4—4 in Fig. 1;

Fig. 5 is an enlarged fragmentary cross sectional view taken along line 5—5 in Fig. 1;

Fig. 6 is a perspective view illustrating a length of zigzag wire stock in various stages of being formed into a tire insert by the apparatus of this invention;

Fig. 7 is a somewhat schematic side elevational view of an apparatus embodying a modified form of the present invention;

Fig. 8 is an enlarged fragmentary view taken along line 8—8 in Fig. 7;

Fig. 9 is an enlarged fragmentary cross sectional view taken along line 9—9 in Fig. 7;

Fig. 10 is an enlarged fragmentary cross sectional view taken along line 10—10 in Fig. 7;

Fig. 11 is an enlarged fragmentary cross sectional view taken along line 11—11 in Fig. 7; and

Fig. 12 is an enlarged fragmentary cross sectional view taken along line 12—12 in Fig. 7.

Referring now more specifically to the drawings wherein like parts are designated by the same numerals throughout the various figures an apparatus 14 embodying the principles of this invention is illustrated best in Fig. 1. This apparatus includes wire bending and forming means 16, 18 and 20 spaced along a predetermined path of travel of zigzag wire stock 22 for progressively bending the wire stock to form a tire insert. Fig. 6 illustrates a length of zigzag wire stock 22 which has been formed by the apparatus of this invention. As shown at the upper left hand end of Fig. 6 the wire stock 22 initially comprises a plurality of transversely extending sections disposed substantially in a common plane. As the wire passes through the means 14, end portions 24 of the transverse wire section are first bent out of the common plane by the bending means 16 and then are bent by the bending means 18 to form the transverse wire sections generally into U-shapes. In the particular embodiment of the tire insert illustrated the outer or free ends of the transverse wire portions 24 are bent inwardly as at 26 and mid-portions of the transverse wire sections are bent to provide inwardly extending projections 28 by the bending apparatus 20.

The bending means 16 includes a pair of opposed rollers 30 and 32 respectively mounted on drive shafts 34 and 36. These rollers are adapted to grip mid-portions of the wire stock passed therebetween as shown best in Fig. 3 and feed the wire through the apparatus. The rollers 30 and 32 also retain the wire stock in the proper position while the wire is being bent and in order to further retain and guide the wire stock through the bending means 16, guide blocks 38, 40, 42 and 44 are suitably mounted on opposite sides of the path of travel of the wire.

In order to bend the wire stock the bending means 16 is provided with a pair of elongated rollers 46 and 48 disposed on opposite sides of the rollers 30 and 32 and respectively mounted on shafts 50 and 52 extending generally along the path of travel of wire. The roller 46 is provided with a continuous helical groove 54 having a lead substantially equal to the lead of the zigzag wire stock and the roller 48 is provided with a similar groove 56 which is axially offset from the groove 54 whereby opposite ends of the transverse wire sections may be received in and fed by the grooves 54 and 56 upon rotation of the rollers. It should be noted that the wire moves from the entering or right hand end of the rollers 46 and 48 as viewed in Fig. 2 toward the left and that the grooves diminish in depth from the right-hand end to the left-hand end of the rollers. With this structure it is seen that as the zigzag wire passes between the rollers 46 and 48, the portions 24 of the wire will be bent as shown in Fig. 3 since the mid-portions of the wire are held in substantially a common plane by the rollers 30 and 32 and the guide members 38—44 while the wire end portions 24 are bent from this common plane by the rollers 46 and 48. While the grooves 54 and 56 are shown as being diminishing in depth it should be understood that the grooves might be substantially uniformly formed throughout their entire lengths and at the same time the rollers 46 and 48 could be inclined relative to the path of travel of the wire in order to bend the end portions of the wire.

The bending means 18 is substantially identical to the bending means 16. Thus, the means 18 includes a pair of retaining and feeding rollers 58 and 60 respectively mounted on drive shafts 62 and 64 and a pair of cooperating elongated bending rollers 66 and 68 mounted on shafts 70 and 72. In addition, guide members 74, 76, 78 and 80 are provided for further retaining the wire stock between the rollers 66 and 68. The only substantial difference of the bending means 18 over the

bending means 16 is that the helical grooves in the rollers 66 and 68 are formed in a manner to bend the end portions 24 of the wire stock from the position shown best in Fig. 3 to the position shown in Fig. 4 so that the transverse wire sections are formed into U-shapes.

The bending means 20 also includes feeding and retaining rollers 82 and 84 mounted on shafts 86 and 88. However, in the particular embodiment illustrated the rollers 82 and 84 differ from the previously described feeding and retaining rollers 30 and 32 in that the roller 84 is provided with an annular rib 90 and the roller 82 is provided with an annular cooperating groove 92 for forming the inwardly extending projection 28 in the transverse sections of the wire stock. The bending means 20 also includes a pair of oppositely disposed rollers 94 and 96 suitably mounted on drive shafts 98 and 100 and provided with suitably formed wire bending peripheral surfaces 102 and 104. In the particular embodiment illustrated in Fig. 5 the peripheral bending surfaces 102 and 104 are shaped to bend the ends of the wire portions 24 inwardly as at 26 and the roller 82 is preferably formed thinner than the roller 84 to permit this inward bending of the wire end portions.

It is understood that the drive shafts of the various rollers described above are driven in predetermined timed relationship with each other and that the wire is fed at a predetermined rate of speed by these rollers. The means for driving the above described rollers may be of any suitable well known structure such as gears, belts and the like, not shown, and the apparatus may be continuously driven by any suitable motor not shown.

In Figs. 7–12 there is illustrated an apparatus 110 embodying a modified form of the present invention. This apparatus includes a series of bending means 112, 114 and 116 spaced along a predetermined path of travel of the zigzag wire stock 22. The bending means 112 includes a pair of revolvable endless chains 118 and 120 which are disposed on opposite sides of the path of travel of the wire. The chain 118 is wrapped around a sprocket 122 mounted on a drive shaft 124 and an idler sprocket 126 mounted on shaft 128. The chain 120 is similarly wrapped around a sprocket 130 mounted on a drive shaft 132 and an idler sprocket 134 mounted on shaft 136. The chains 118 and 120 respectively include a series of die blocks 138 and 140. As shown best in Fig. 8 one side of the chain 118 is provided by conventional links 142 connected together by pins 144 and the opposite side of the chain is provided by the die blocks 138. The chain 120 is similarly constructed and need not be described in detail. As shown best in Figs. 9 and 10 each die block 138 is provided with a longitudinally extending channel or groove 146 preferably having a substantially flat bottom and substantially flat perpendicularly extending side walls 148 and 150. Each die block 140 is provided with a projection 152 having a generally rectangular transverse cross section and adapted to enter the cavity 146. As the wire enters between the chains 118 and 120 it is clamped between the projection 152 and corners 154 and 156 of the die block 138 to prevent lateral shifting thereof and subsequently bent as shown in Fig. 10. By bending the wire in this manner with the elongated chains 118 and 120 the wire may be positively held in the bent condition for a relatively long period to assure a permanent set in the wire. To accomplish this it is necessary to prevent the adjacent runs of the chains 118 and 120 from springing away from each other and, therefore, pressure guide bars 158 and 160 are provided.

The bending means 114 is provided with a pair of opposed wire retaining and feeding rollers 158 and 160 and these rollers are respectively mounted on drive shafts 162 and 164. At opposite sides of the rollers 158 and 160 is disposed a pair of endless chains 166 and 168 which are generally similar to the above described endless chains and carry a series of die blocks 170. The chains 166 and 168 are of course wrapped around suitable sprockets mounted on shafts 172 and 174. The die blocks 170 are shaped to bend the outer or free ends of the U-shaped transverse wire sections inwardly as shown best in Fig. 11 and pressure bars 176 and 178 are provided for holding the chains 166 and 168 inwardly against the wire.

The bending means 116 is essentially identical to the above described bending means 112 and, thus, includes a pair of endless chains 180 and 182 respectively having a series of die blocks 184 and 186. The chain 180 is wrapped around a sprocket 188 mounted on a drive shaft 190 and a second sprocket 192 mounted on a shaft 194. The chain 182 is similarly wrapped around a sprocket 196 mounted on a drive shaft 198 and an idler sprocket 200. Pressure bars 202 and 204 are provided for urging the die blocks 184 and 186 into cooperating relationship. It is thus seen that the bending means 116 is identical to the means 112 except for the shape of the die blocks. The die blocks 184 are provided with a rib 206 adapted to cooperate with a groove 208 formed in the die block 186 to form the inwardly extending projections 28 in the wire. In addition, the die blocks 186 are provided with grooves 210 for receiving the end portions of the traverse wire sections and preventing the end portions from flaring outwardly while the projections 28 are being formed.

While the apparatus 110 has been somewhat diagrammatically illustrated in Fig. 7 it is understood that a suitable source of power such as an electric motor, not shown, and gears or drive belts, not shown, will be provided for rotating the drive shafts of the various endless chains and rollers in predetermined timed relationship for continuously processing the wire at a relatively high speed.

From the above description it is seen that the present invention has provided a novel apparatus whereby wire articles of the type contemplated herein may be rapidly and continuously formed from zigzag wire stock in an economical manner. In addition, it is seen that the present invention has provided a novel apparatus for continuously forming wire articles relatively rapidly about the same time the zigzag wire stock is retained in a predetermined position so that it may be accurately formed.

While the preferred embodiments of the present invention have been shown and described herein it is obvious that many structural details may be changed without departing from the spirit and scope of the appended claims.

The invention is claimed as follows:

1. A power operated apparatus for forming tire inserts from zig-zag wire stock having transverse sections disposed substantially in a common plane while the stock is moving continuously along a path of travel, the combination comprising a plurality of pairs of adjacently located revolvably driven die means disposed on opposite sides of said path of travel for progressively and continuously engaging opposite end portions of said transverse wire sections along substantial lengths of said path of travel and for bending said end portions of said transverse wire sections out of said common plane and generally into U-shapes, and endless revolvable means disposed between at least one of said pairs of revolvably driven die means for engaging mid portions of said transverse sections and retaining the zig-zag wire stock in position between said last mentioned revolvably driven die means, one of said pairs of revolvably driven die means including a pair of rollers disposed with their axes extending generally along said path of travel, and means providing helical grooves in said rollers with the bottom of said grooves converging toward each other, said grooves being adapted to receive and retain end portions of said transverse wire sections and to feed said end portions axially of said rollers, said end portions being bent out of said common plane as they advance in the converging grooves.

2. An apparatus, as defined in claim 1, wherein the helical groove in at least one of said rollers is diminishing in depth from its entering end to its discharge end.

3. An apparatus, as defined in claim 1, wherein one said pairs of revolvably driven die means includes means for bending mid portions of said transverse wire sections to provide said mid portions with inwardly extending projections.

4. In a power operated apparatus for forming tire inserts from zig-zag wire stock having transverse sections disposed substantially in a common plane while the wire stock is moving continuously along a path of travel, the combination comprising a plurality of pairs of adjacently located revolvably power driven die means disposed on opposite sides of said path of travel for progressively and continuously engaging opposite end portions of said transverse wire sections along substantial lengths of said path of travel and bending said end portions of said transverse wire sections out of said common plane and generally into U-shapes, and endless revolvable means disposed between at least one of said pairs of revolvably driven die means for engaging mid portions of said transverse sections and retaining the zig-zag wire stock in position between said last mentioned revolvably driven die means, one of said pairs of revolvably driven die means including a pair of endless chains, means for supporting said chains for endless motion, and a series of die blocks movable with each of said chains, said die blocks being cooperable to form the wire stock disposed therebetween.

5. In a power operated apparatus for forming tire inserts from zig-zag wire moving continuously along a path of travel, the combination comprising revolvable means for combining mid portions of transverse sections of the zig-zag wire moving along said path of travel, which mid portions are substantially disposed in a predetermined plane, and a pair of power driven rollers disposed adjacent said confining means respectively extending generally along opposite edges of said path of travel and offset from said one side of said plane, each of said rollers having means providing a helical groove therein for receiving and retaining end portions of said transverse wire sections, said grooves having bottom surfaces inclined toward the path of travel from the entering ends toward the discharge ends of the grooves whereby said rollers are operable to bend end portions of said transverse wire sections advancing through said grooves outwardly from said one side of said plane.

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