A method and means for providing a substantially continuous resilient article such as a foamed plastic doll body or the like with a bendable wire skeleton, particularly useful when the article in question is substantially seamless in nature and must be removed from a mold through a limited opening so that the wire skeleton could not be incorporated in the article during the molding operation. Means are provided for initially forming channels in the article with wire elements being inserted into the channels in a manner so that they generally overlap at a point where they are consolidated, for example, by twisting the trailing end portions of the wire elements upon each other. The leading end portions of the wire elements may be blunted by forming a loop thereon so as to minimize the possibility of piercing the surfaces of the article with relatively sharp wire tips which could cause injury in use of the article. Additionally, the twisted trailing end portions of the article may be looped and if a doll body or the like is being provided with the bendable wire skeleton a hollow head portion may be attached to the doll body in a conventional manner thereby covering the consolidated trailing end portions of the elements so that the wire skeleton is completely internal of the final article.

26 Claims, 13 Drawing Figures
METHOD AND MEANS FOR PROVIDING SUBSTANTIALLY CONTINUOUS RESILIENT ARTICLE WITH BENDABLE SKELETON AND RESULTANT ARTICLE

This invention relates to a method and means for providing a substantially continuous resilient article with a bendable wire skeleton and the products so-produced and relates more particularly to the provision of a bendable wire skeleton within a substantially seamless foamed plastic doll body.

As background for the instant inventive concepts, reference may be made to U.S. Pat. No. 3,532,581 issued Mar. 11, 1969 to Jacob J. Rosen, which patent is directed to techniques for forming foamed articles, such as doll bodies and like. The disclosure of this patent is incorporated herein in its entirety by reference.

The Rosen patent teaches the production of substantially solid or continuous foamed articles from materials such as polyvinyl chloride plastisols or the like which are relatively resilient in nature. With articles of this type, it is sometimes desirable to incorporate a skeleton for reinforcing purposes and, additionally, to enable portions of the article to be bent to a given position and retained in that position. Since the material of the article itself is quite resilient, in the absence of an internal bendable wire skeleton, it is impossible to provide an article such as a doll body of the like wherein portions thereof, such as the appendages, can be bent relative to other portions, such as the torso, and retained in a desired position.

The aforementioned Rosen patent discloses a technique for incorporating a bendable wire skeleton into the article during the molding process. While this technique is quite satisfactory when operating in a "split" mold, a bendable wire skeleton cannot be inserted during the manufacturing process when the product that is being produced is a "seamless" substantially continuous foamed plastic article such as results from the process disclosed in U.S. application Ser. No. 806,180 filed Mar. 11, 1969 by Richard Bruce Johnson and George Winn, now abandoned, the subject matter of which is also incorporated herein in its entirety by reference. In that application techniques are disclosed for producing an article such as a doll body wherein the body portion and the appendages are substantially free of seams. With the technique disclosed in application Ser. No. 806,180 the substantially continuous foamed plastic article must be "striped" through a relatively small opening in a main mold part in order to avoid the production of seams thereon. If a wire skeleton or the like was incorporated in the article during the molding technique it could not be stripped through the relatively small opening. With articles of this type, completely different techniques must be utilized if a bendable wire skeleton is desired.

Although the instant inventive concepts are particularly useful in providing an article such as produced according to the techniques of application Ser. No. 806,180, with a bendable wire skeleton after it has been removed from the mold, it will be obvious that the method and means of this application are useful with other articles and, for example, could even be used to provide a bendable wire skeleton in an article produced in a "split" mold such as disclosed in Rosen U.S. Pat. No. 3,432,581. Also, although the instant invention is particularly useful in providing a bendable wire skeleton in a doll body or the like, it has more general applicability and could be used to provide reinforcement skeletons or bendable skeletons for other articles. Additionally, the article need not necessarily be formed of a foamed plastisol or other plastic composition, but could be formed of a solid plastic or rubber composition.

The term "wire" as used throughout the instant specification and the appended claims is intended to cover any elongated element which need not necessarily be circular in cross-section and could, in fact, be a web or the like which is greater in one cross-sectional direction than another, although the length of the element must obviously be substantially larger than any of its transverse dimensions. Thus, this term shall be considered to include any and all elongated filamentary-type materials. Yet, in the preferred embodiments hereof the wire material in question will be an ordinary thin metallic element of the type usually utilized for the production of a bendable wire skeleton in a doll body such as disclosed in Rosen U.S. Pat. No. 3,432,581.

Also, although the instant inventive concepts are to be broadly interpreted as applicable to providing a bendable wire skeleton in various articles, according to the preferred embodiments hereof, the method and means disclosed herein are particularly adapted to providing a bendable wire skeleton in a substantially seamless continuous foamed plastic article of the type produced by the procedures set forth in U.S. application Ser. No. 806,180.

Thus, as will be seen from the foregoing, the basic objects of this invention are directed to the provision of a method and means for providing a substantially continuous resilient article with a bendable wire skeleton in a manner which is simple and relatively inexpensive, but results in a product having all of the desirable characteristics of an article wherein the bendable wire skeleton is incorporated during the molding procedure.

Another object of this invention is to provide a doll body or the like with a bendable wire skeleton wherein the skeleton is formed in a manner that minimizes the possibility that any portion of this skeleton will pierce through the exterior surface of the product during use of the product.

Other and further objects of this invention will be readily understood by reference to the following detailed description and the accompanying drawings wherein:

FIG. 1 is a schematic plan view of a preferred apparatus according to the instant invention;
FIGS. 2 and 3 are schematic illustrations of the manner of forming channels in the appendages of a doll body in stations 1 and 2 shown in FIG. 1;
FIGS. 4 and 5 are schematic illustrations of the manner of forming a looped or blunted end on the wire before inserting same into the channels;
FIG. 6 is a schematic illustration showing the insertion of the wire into one of the channels;
FIGS. 7 and 8 are enlarged schematic views showing the detailed insertion of the wire into a channel and the application of an adhesive coating on the wire as the means which guide the wire into the channel is withdrawn;
3,706,330

FIG. 9 is a schematic illustration showing the severing of a wire element after it has been fully inserted, the steps shown in FIGS. 4-9 inclusive all taking place in each of stations 3-6 of FIG. 1 with different wire elements.

FIGS. 10 and 11 are schematic illustrations of the means for twisting the trailing end portions of all of the wire elements on each other and forming a looped end therefrom, these operations taking place in station 7 of FIG. 1.

FIG. 12 is a schematic illustration of the completed article within its nest or supporting means; and FIG. 13 is a schematic illustration of the final product resulting from the techniques and apparatus shown in FIG. 1 with a hollow head attached to the doll body shown in dotted lines.

Like reference characters refer to like parts throughout the several views of the drawings.

Referring now to the drawings in general and more particularly to FIG. 1, the basic apparatus of this invention is designated generally by the reference numeral 20 and comprises basically a supporting mechanism 22 in the form of a nest or the like for carrying the article 24 which is to be provided with a bendable wire skeleton; a pair of channel forming stations 26, 28 for forming elongated channels in the article; four wire inserting stations, 30, 32, 34, and 36 for looping or blunting the end of the wire, feeding the wire into a selected channel, coating the wire with an adhesive and severing a predetermined length of the wire related to the length of its respective channel; a consolidating station 38 for joining the trailing end portions of all of the lengths of wire to each other by twisting the trailing end portions together and then looping the twisted trailing end portions; and power supply means 40 which may be of any conventional nature and which inter alia functions as an indexing means for sequentially moving the table 42 with the supporting means 22 thereon to position the article 24 in operative relation with each of the stations.

Referring now more particularly to FIGS. 2 and 3, it will be seen that each of the channel-forming stations 26, 28, which are basically mirror-images of each other, includes a pair of channel-forming means 44, 46, 48 and 50 which include reciprocally mounted probe elements for piercing the material of the article 24 to form the elongated channels therein. The channels, for simplicity, are designated by the same reference numerals as their probes followed by a prime. The channel-forming means 44-50 are each supported on a carriage with reciprocating means operated associatively therewith for moving the probes individually and sequentially forward to pierce their respective channels and then for withdrawing the probes so that successive channels can be formed. It will be noted that in station 1 channels are formed in the leg and arm portions of the articles 24 on one side thereof, following which the support means is indexed to station 2 wherein the probes thereof are successively operated to form channels in the appendages on the opposite side of the article 24.

Referring now particularly to FIGS. 4-9 and stations 3-6, one of the inserter means will be described in detail, it being recognized that each of the inserter means are substantially identical, four such means being provided since the particular product being produced in the illustrative embodiment includes four wire elements in its skeleton. Each inserter means includes a source of wire schematically shown as a roll or the like 52, a looper means 54 for forming a blunt leading end portion on the wire before insertion thereof into its respective channel, feeding means 56 to be described in more detail hereinafter for inserting the wire from the source 52 into the channel, and cutting means 58 for severing the wire to a predetermined length related to the length of its respective channel.

The looper means 54, as will be seen particularly in FIG. 4, includes a pair of pin means 60, 62 which extend generally transversely to the path of travel of the wire and between which the leading end portion of the wire is positioned. The looper means 54 is preferably pivotally or otherwise carried so that it can be selectively moved into the path of travel of the wire to perform its function and then moved out of the path of travel of the wire so that the wire can be inserted into its respective channel. The pin means 60 is stationary and rotating drive means schematically illustrated at 64 are operatively connected to the pin means 62 for moving the pin means 62 about the axis of the pin means 60 to bend the leading end portion of the wire about the pin means 60 and form a loop such as shown at 66 on the leading end portion of the wire. Both pin means 60, 62, may be mounted for rotation about their own axes to facilitate the looping operation.

The feeding means 56, as will be seen particularly in FIGS. 7 and 8, preferably include a hollow guide sheath through which the wire passes, the forward end of the sheath 68 being juxtaposed to the leading end portion of the wire prior to insertion of the wire into its respective channel. Adhesive-applying means designated generally by the reference numeral 70 are preferably associated with the feeding means and include a pair of conduits movable with the sheath 68 and having outlet portions juxtaposed to the forward end of the sheath 68. Reciprocating means designated schematically by the arrows 72, 74 function to insert the sheath 68 and the conduit means along with the wire into its respective channel and withdraw the sheath and conduit means from the channel after the wire has been fully inserted thereinto. As shown in FIG. 8, an adhesive material 76 which is compatible with both the material of the wire and the material of the article 24 is extruded from the adhesive-applying means 70 as the sheath and conduit are withdrawn to thereby coat the wire with the adhesive and facilitate securement of the wire to the article 24.

Following complete withdrawal of the sheath and conduit means, the cutting means 58 sever a selected length of the wire.

Referring now particularly to FIGS. 10-12 and station 7 of FIG. 1, it will be seen that the various channels are formed in such a manner that they generally diverge from a common point located in the vicinity of the neck portion of the article 24. The lengths of wire are cut so that they extend slightly beyond this point and generally overlap at this point. The consolidating means 38 preferably include gripping means illustrated generally by the reference numeral 80 which function to selectively grasp all of the lengths of wire at about the point at which they overlap and hold the wire ele-
ments stationary at that point. Additionally, twister means designated generally by the reference numeral 82 are provided for grasping all of the lengths of wire at about their trailing ends as shown in FIG. 11 and twisting the trailing end portions of the wire about each other.

Additionally, the consolidating station 38 may include a looper means 84 which, after the grasping and twister means 80, 82 are withdrawn, function to form a loop 86 on the twisted trailing end portions of the bundle of wire elements in a manner similar to which the loops 66 are formed on the leading end portions of the wire elements before insertion into their respective channels.

As will be seen in FIG. 13, the final article produced according to the preferred techniques of the instant inventive concepts includes the doll body 24 with its torso 88, its legs 90,92 and its arms 94, 96 and a peripheral flange 98 and its neck portion 100, a consolidated wire skeleton 102 being carried therein and a head portion 104 being secured over the flange 98 to cover the loop 86. According to the techniques of application Ser. No. 806,180, referred to hereinabove, in order to facilitate stripping the article 24 from its substantially seamless mold part, a limited internal discontinuity 106 is formed during the molding operation. It is within this discontinuity that all of the wire elements of the skeleton 102 merge and are joined at about the neck portion 100.

Although not specifically shown in the drawings, it is obvious that the apparatus of this invention will incorporate various motor means or hydraulic fluid cylinder devices and various limit switches for selectively performing the functions referred to. For example, of course, motor means or the like must be provided for reciprocating the individual probes 44-50, for feeding the wire and reciprocating the guide sheath and adhesive supply conduits, for moving the looper means into operative position, for operating the cutting means, for operatively engaging the gripping and twister means and for indexing the table 42. The power supply 40 is to be considered as illustrative of the overall means necessary to perform this function, although each of the stations may incorporate their own power driving means and hydraulic systems along with an overall control circuit for operating the various parts in sequence. Basically, all that is necessary to provide an article with a wire skeleton according to the instant inventive concepts is an operator who places an article in a support means in advance of station 1 and who begins the overall operation of the equipment. When the support means is returned following station 7, the completed product is removed and a new article is placed in the support means for the next cycle. Additionally, if desired, a plurality of support means may be carried on the table 42 so that one support means will be positioned at each station during a continuous operation of the equipment.

The details of the adhesive can be varied depending upon the materials of the wire and the article, but with a foamed plastisol doll body or the like a water-based vinyl cement which is non-toxic is preferred. Alternatively, the adhesive applying means can be completed eliminated, relying on the resilient nature of the material of the article to retain the wire elements in position.

Additionally, any conventional heat setting adhesive may be utilized with induction or other dielectric heating means being utilize to raise the temperature of the wire and/or the adhesive from outside the article thereby setting the adhesive. Moreover, the wire itself may be coated with a compatible material such as a foamed or unfoamed plastisol prior to coiling the wire onto the supply roll.

Although the channel-forming means is illustratively shown as a probe which merely pierces the material of the article, other techniques may be utilized for forming the channels. For example, a hot wire or rod can be used to burn channels in the product, although with plastisol materials this technique is undesirable since it can produce chlorine gas. While a looper means is shown for blunting the leading end portions of the wire elements before insertion into their respective channels, other techniques may be utilized to minimize the possibility of the wire piercing through the article surface which could result in injury to someone utilizing the article. Similarly, the trailing end portions of the bundle of wire elements could be bluntly by means other than a looper means or, other means could be utilized in addition to the looper means to cover the trailing end portions for safety purposes. For example, the bundle of wires could be coated with a protective covering by heating the same and dipping them in a vinyl plastisol or the like. Alternatively, a wire nut could be placed over the trailing end portions of the bundle of wires or a soft plastic or metal nut or sleeve could be crimped or crushed over the trailing end portions of the wire bundle. A piercing tool could be provided to spread the trailing end portions and bend them all back into a plurality of individual loops. Further, the trailing end portions of the wire elements could be consolidated by spot welding them to each other following which they could be ground to a rounded or smooth surface. These alternatives are merely disclosed to illustrate the various modifications to the apparatus and techniques described herein which may be incorporated without departing from the instant inventive concepts.

Additionally, while two mirror-image channel-forming stations are shown, obviously four separate stations could be utilized or, possibly, all four channel-forming means could be incorporated into a single station. Similarly, while four separate wire-inserting means have been illustrated, these too could be modified so that only a single station would be necessary with either the station or the article supporting means being moved slightly to align the wire with a selected channel in the article. Conventional devices such as wire straighteners (illustratively shown at 106 in FIG. 1) and other such means can readily be incorporated into the overall apparatus of this invention.

It will now be seen that there has been herein provided an improved method and means for providing a substantially continuous resilient article with a bendable wire skeleton and an improved product resulting therefrom, all of which satisfies the various objectives set forth hereinabove and have great commercial importance and practical utility.

What is claimed is:
1. An apparatus for providing a substantially continuous resilient article with a bendable wire skeleton comprising, in combination, a supporting mechanism for removably carrying the article; channel-forming means for forming a plurality of elongated channels in the article; inserter means including a source of wire; feeding means for inserting wire from said source into each channel formed in the article by said channel-forming means; cutting means for severing the wire to a predetermined length related to the length of their respective channels; indexing means for sequentially moving said supporting mechanism to position the article in operative relation with each of said means; and consolidating means for consolidating all of said lengths of wire at least at one point to form the skeleton.

2. An apparatus for providing a substantially continuous resilient article with a bendable wire skeleton comprising, in combination, a supporting mechanism for removably carrying the article; a plurality of channel-forming means for forming a plurality of elongated channels in the article; at least one inserter means including a source of wire; feeding means for inserting wire from said source into each channel formed in the article by said channel-forming means; cutting means for severing the wire to a predetermined length related to the length of its respective channel; and indexing means for sequentially moving said supporting mechanism to position the article in operative relation with each of said means; and consolidating means for consolidating all of said lengths of wire at least at one point to form the skeleton.

3. The apparatus of claim 2 wherein said channel-forming means are arranged to form channels which extend from one surface of the article to predetermined points within the article, said inserter stations including means for forming a blunt leading end portion on the wire prior to feeding the wire into each of said channels to minimize the possibility of the leading end portion of the wire piercing through the surface of the article beyond the end of its related channel.

4. The apparatus of claim 3 wherein said means for forming a blunt leading end portion on the wire includes looper means, said looper means bending the leading end portion of the wire at least about 180°.

5. The apparatus of claim 4 wherein said looper means includes a pair of pin means extending generally transversely to the path of travel of the wire and between which the leading end portion of the wire is positioned, one of said pin means being station, and rotating drive means for moving the other of said pin means about the axis of said one pin means to bend the leading end portion of the wire about said one pin means.

6. An apparatus for providing a substantially continuous resilient article with a bendable wire skeleton comprising, in combination, a supporting mechanism for removably carrying the article; at least one channel-forming means for forming elongated channels in the article; at least one inserter means including a source of wire; feeding means for inserting wire from said source into each channel formed in the article by said channel-forming means; cutting means for severing the wire to a predetermined length related to the length of its respective channel; and indexing means for sequentially moving said supporting mechanism to position the article in operative relation with each of said means; each of said inserter means further including adhesive-applying means for coating the wire with an adhesive compatible with the material of the wire and the material of the article.

7. The apparatus of claim 6 wherein each of said inserter means includes a hollow guide sheath into which the wire is fed by said feeding means, said sheath having a forward end juxtaposed to the leading end portion of the wire prior to insertion of the wire into each of said channels, said adhesive-applying means including conduit means defining an outlet juxtaposed to said forward end of said sheath, reciprocating means for inserting said sheath and said conduit means along with the wire into each of said channels and for withdrawing said sheath and said conduit means from said channel after the wire has been fully inserted into said channel, and means for feeding adhesive through said outlet of said conduit means over the length of said channel as said sheath and said conduit means are withdrawn therefrom.

8. The apparatus of claim 2 wherein said consolidating means includes gripping means for grasping all of the lengths of wire at about the point at which they overlap and holding the wires stationary at that point, and twister means for grasping all of the lengths of wire at about the trailing ends thereof and twisting the trailing end portions of the wires about each other.

9. The apparatus of claim 8 further including looper means for bending the twisted trailing end portions of the wire at least about 180°.

10. The apparatus of claim 9 wherein said looper means includes a pair of pin means extending generally transversely to the length of the twisted trailing end portions of the wires, one of said pin means being station, and rotating drive means for moving the other of said pin means about the axis of said one pin means to bend the twisted trailing end portions of the wire about said one pin means.

11. An apparatus for providing a substantially continuous resilient article with a bendable wire skeleton comprising, in combination, a supporting mechanism for removably carrying the article; channel-forming means for forming elongated channels in the article; inserter means including a source of wire; feeding means for inserting wire from said source into each channel formed in the article by said channel-forming means; cutting means for severing the wire to a predetermined length related to the length of its respective channel; and indexing means for sequentially moving said supporting mechanism to position the article in operative relation with each of said means; said article being a substantially continuous foamed doll body having a torso portion with a neck portion and appendages including a pair of arm portions and a pair of leg portions, channel-forming means for consecutively forming a channel in each of the appendages, each of said channels extending from a point within its respective appendage toward a common point near the neck portion, in-
serfer means for inserting lengths of wire into each of said channels, means for forming a blunt leading end portion on the wire prior to feeding the wire into each of said channels to minimize the possibility of the leading end portion of the wire piercing through the surface of its related appendage beyond the end of the channel therein, the trailing end portions of all the lengths of wire overlapping at about said common point and extending slightly therebeyond, said apparatus further including twister means for twisting the trailing end portions of all of the lengths of wire about each other.

12. The apparatus of claim 11 wherein said means for forming a blunt leading end portion on the wire includes looper means for bending the leading end portion of the wire at least about 180°, and further looper means for bending the twisted trailing end portions of all of the lengths of wires at least about 180°.

13. The apparatus of claim 11 wherein each of said inserter means includes a hollow guide sheath into which the wire is fed by said feeding means, said sheath having a forward end juxtaposed to the leading end portion of the wire prior to insertion of the wire into its respective channel, adhesive-applying means including conduit means having an outlet juxtaposed to said forward end of said sheath and a source of adhesive, compatible with the wire and the material of the doll body, communicating with said conduit means, reciprocating means for inserting said sheath and said conduit means along with the wire into its respective channel and for withdrawing said sheath and said conduit means from said channel after the wire has been fully inserted into said channel, and means for feeding adhesive from said source through said outlet of said conduit means over the length of said channel as said sheath and said conduit means are withdrawn therefrom.

14. The apparatus of claim 11 including a pair of substantially mirror image channel-forming stations each including a pair of channel-forming probes, said pair of channel-forming probes in each station being arranged for forming channels in a leg portion and an arm portion on one side of the doll body, and reciprocating means for consecutively reciprocating each of said channel-forming probes to form said channels by piercing the material of the doll body.

15. A method for providing a substantially continuous resilient article with a bendable wire skeleton comprising the steps of forming a plurality of elongated channels in the article, inserting wire into each of said channels, severing the wire to predetermined lengths related to the length of its respective channel, and consolidating all of said lengths of wire at least at one point to form the skeleton.

16. The method of claim 15 wherein all of said channels diverge from a generally common point with relation to the article, severing lengths of wire which extend past said point so that the trailing end portions of all of the lengths of wire overlap at about said point, and joining the trailing end portions of all of the lengths of wires to each other.

17. The method of claim 16 wherein the channels are formed so as to extend from one surface of the article to predetermined points within the article, further including the step of forming a blunt leading end portion on the wire prior to feeding the wire into each of said channels to minimize the possibility of the leading end portion of the wire piercing through the surface of the article beyond the end of its related channel.

18. The method of claim 17 wherein the blunt leading end portion on the wire is formed by bending the leading end portion of the wire at least about 180°.

19. The method of claim 15 further including coating the wire with an adhesive compatible with the material of the wire and the material of the article.

20. The method of claim 19 wherein the wire is guided into its respective channel by a hollow guide sheath, withdrawing the sheath from said channel after the wire has been fully inserted into said channel, and feeding said adhesive into said channel and over the wire adjacent the forward end of the sheath as the sheath is withdrawn from the channel.

21. The method of claim 16 wherein the trailing end portions of all of the lengths of wire are joined together by grasping all of the lengths of wire at about the point at which they overlap and holding the wires stationary at that point, grasping all of the lengths of wire at about the trailing end thereof and twisting the trailing end portions of the wires about each other.

22. The method of claim 21 further including the step of bending the twisted trailing end portions of the wire at least about 180°.

23. The method of claim 15 wherein the article is a substantially continuous foamed doll body having a torso portion with a neck portion and appendages including a pair of arm portions and a pair of leg portions, consecutively forming a channel in each of the appendages, each of said channels extending from a point within its respective appendage toward a common point near the neck portion, inserting lengths of wire into each of said channels after forming a blunt leading end portion thereon to minimize the possibility of the leading end portion of the wire piercing through the surface of its related appendage beyond the end of the channel therein, the trailing end portions of all of the lengths of wire overlapping at about said common point and extending slightly therebeyond, and twisting the trailing end portions of all of the lengths of wire about each other.

24. The method of claim 23 wherein the blunt leading end portion on the wire is formed by bending the leading end portion of the wire at least about 180°, and further including the step of bending the twisted trailing end portions of all of the lengths of wires at least about 180°.

25. The method of claim 23 wherein the wire is guided into its respective channel by a hollow guide sheath, withdrawing the sheath from said channel after the wire has been fully inserted into said channel, and feeding an adhesive compatible with the material of the wire and the material of the doll body into said channel as the sheath is withdrawn therefrom.

26. The method of claim 23 wherein said channels are formed by piercing the material of the doll body.

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