United States Patent [19]

Knott

[11] **3,812,640**

[45] **May 28, 1974**

[54] **METHOD AND APPARATUS FOR PACKAGING WIRE MESH MATERIAL**

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[52] **U.S. Cl.** ..... **53/14,** 53/21 FW, 53/119, 53/137, 206/59 R

[51] **Int. Cl.** **R65b 63/04**

[58] **Field of Search** ..... 53/21 FW, 118, 119, 214, 53/139.3, 14, 137; 206/59 R

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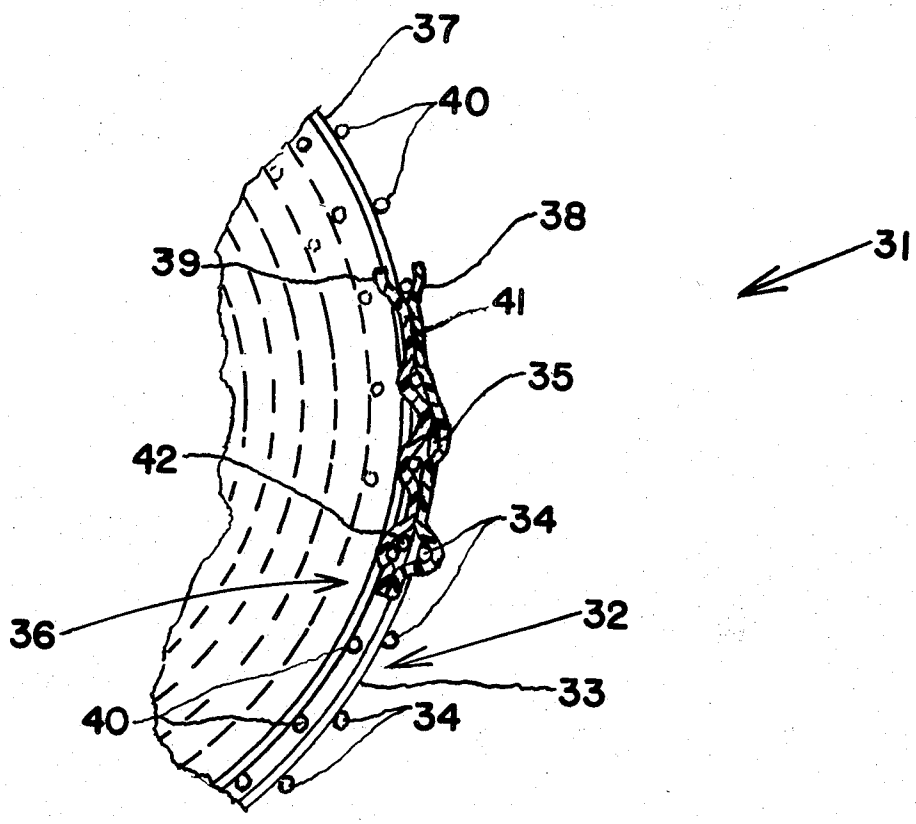
Primary Examiner—Travis S. McGehee

Attorney, Agent, or Firm—John E. Toupal

[57] **ABSTRACT**

Disclosed is a method and apparatus for rolling wire mesh material such as "hex poultry netting." According to the subject method the mesh material is cut forming an edge defined by a plurality of sharp wire ends. After a roll is formed, the edge is affixed to the body thereof to prevent unrolling and a cover is applied over the wire ends.

23 Claims, 10 Drawing Figures



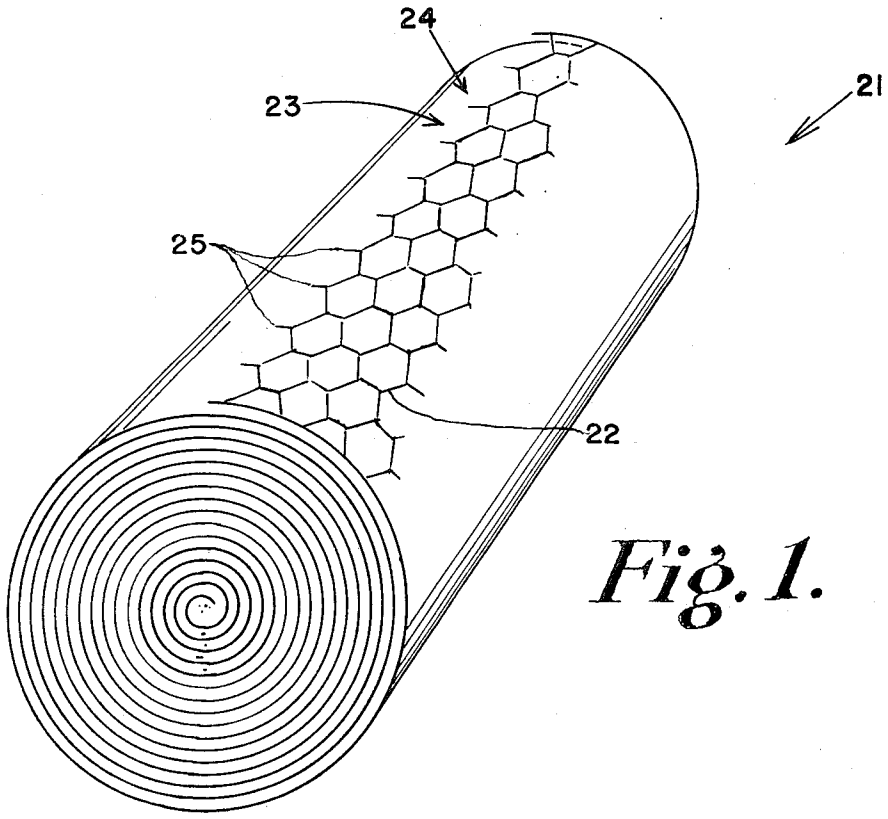


Fig. 1.

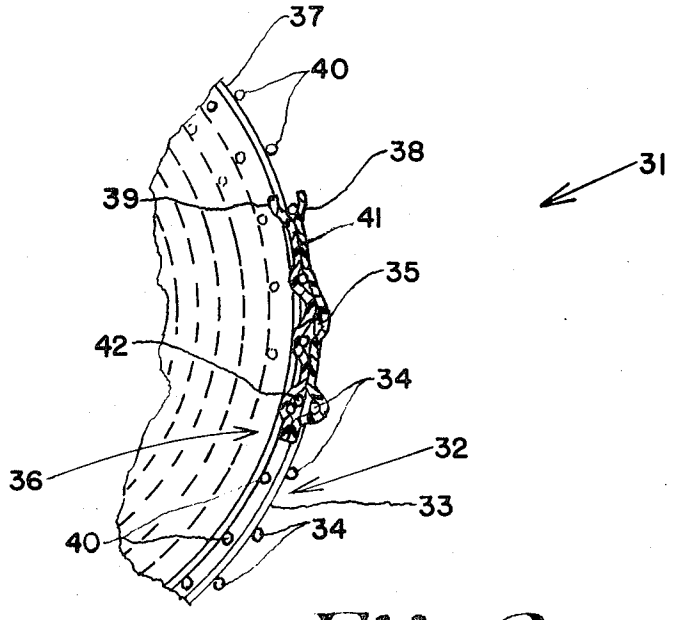


Fig. 2.

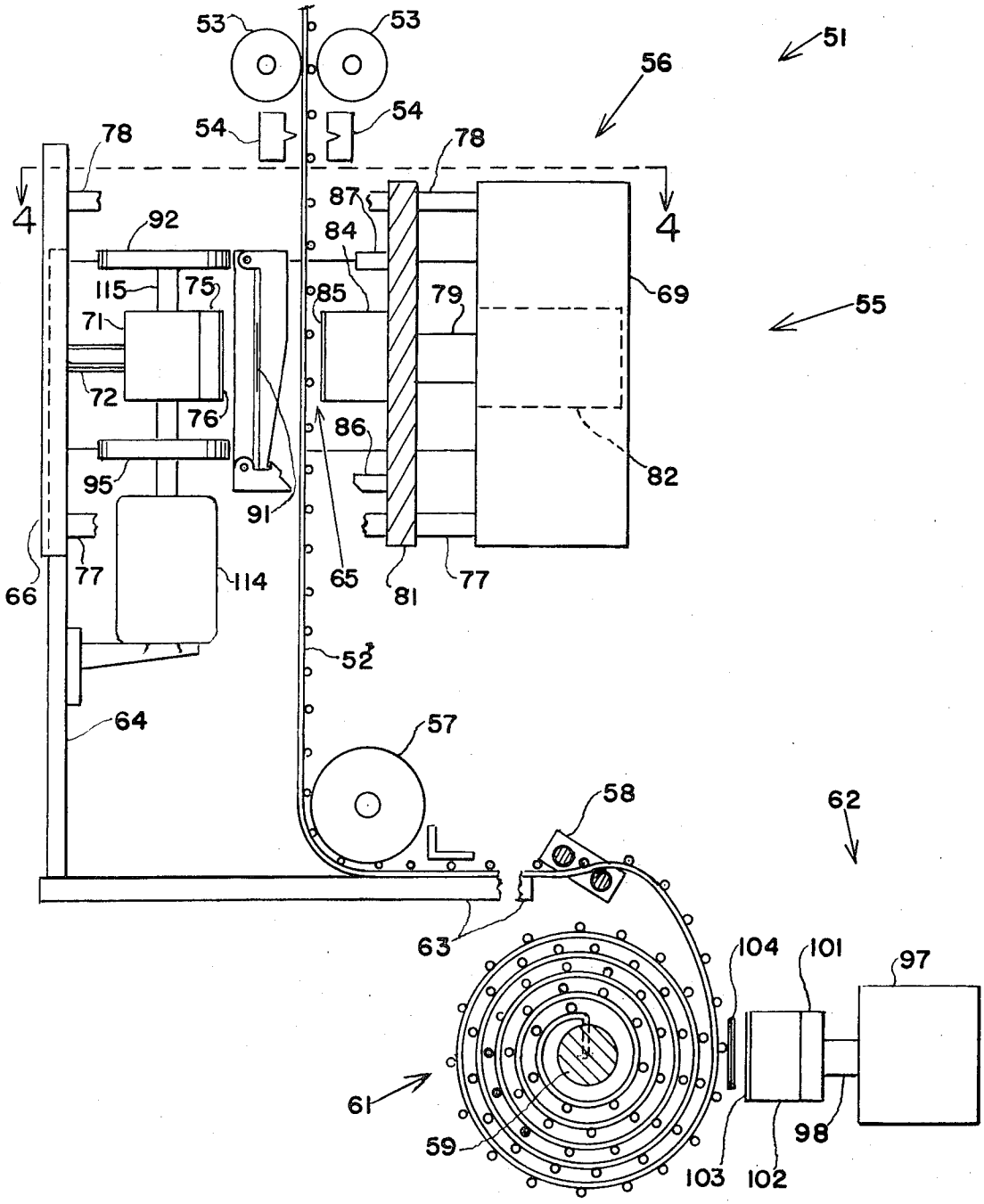

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Fig. 3.

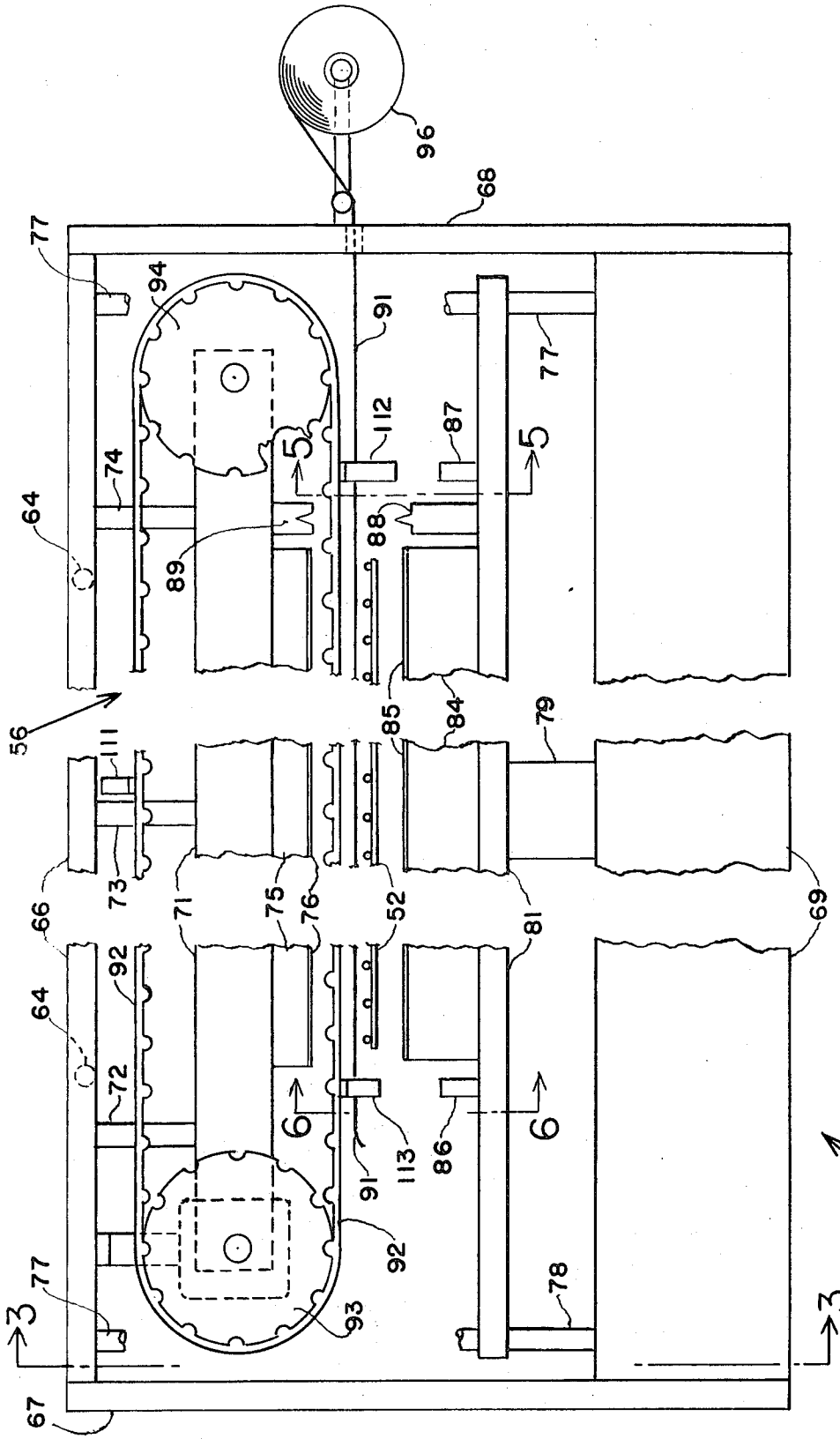

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Fig. 4.

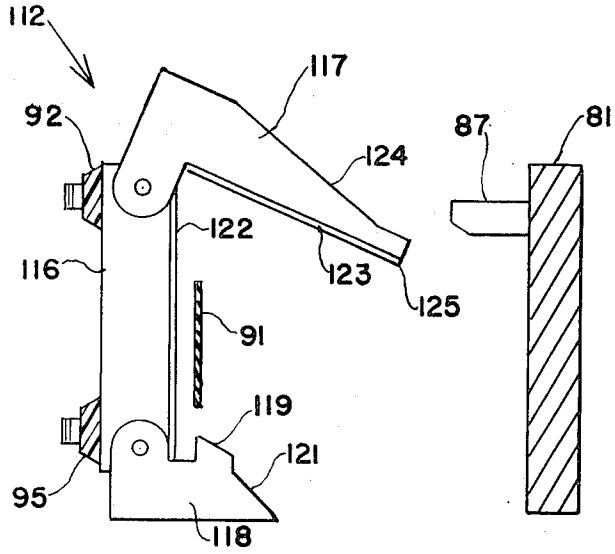


Fig. 5.

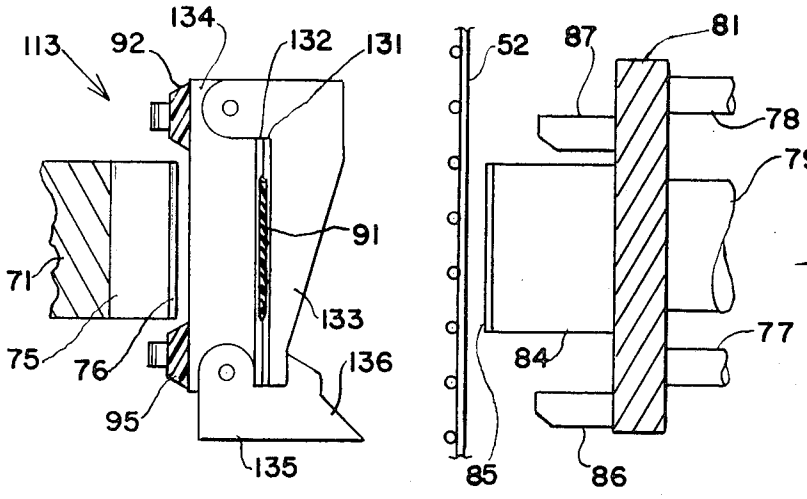


Fig. 6.

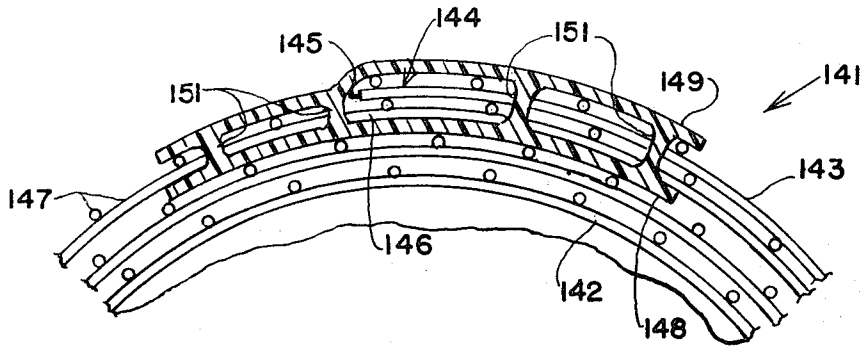


Fig. 7.

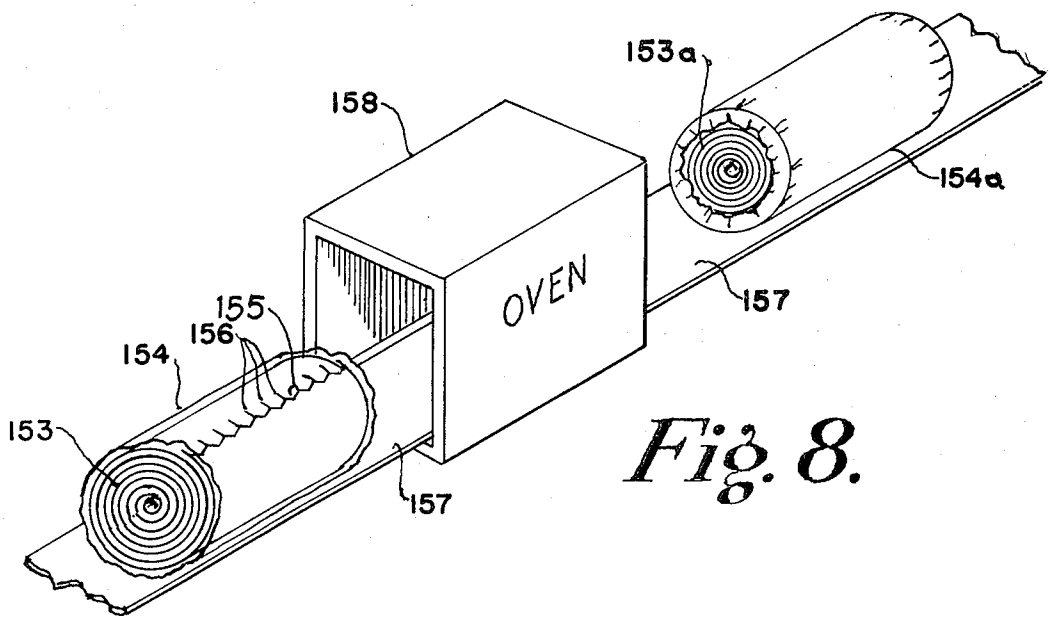


Fig. 8.

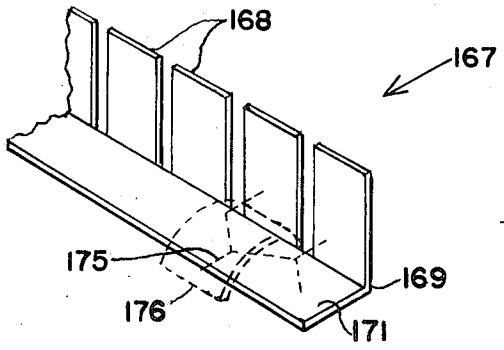


Fig. 9.

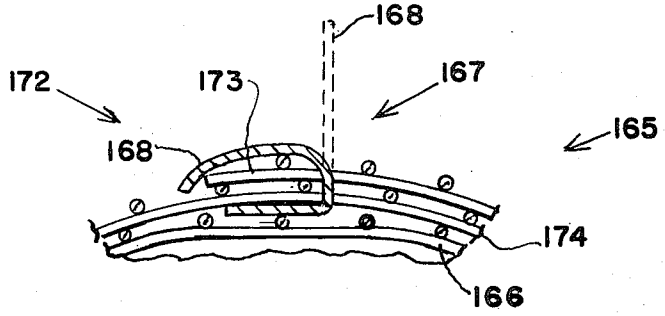


Fig. 10.

METHOD AND APPARATUS FOR PACKAGING WIRE MESH MATERIAL

BACKGROUND OF THE INVENTION

This invention relates to methods and apparatus for rolling wire mesh material, such as "poultry wire", and, more particularly, to securing the outer ends of the rolls to prevent unrolling and covering the sharp wire ends that are produced when the mesh material is cut.

In the manufacture of wire fabric, such as, for example, hex wire netting, the netting is produced by a forming machine from single strands of wire and is discharged from the machine in a continuous strip of predetermined width with selvage edges. Common practice is to wind predetermined lengths of the wire fabric strip as it comes from the forming machine into coils or rolls. After the desired length is wound on an arbor to form a tightly wound roll, the fabric strip is cut transversely producing an edge including sharp wire ends. It is desirable that these wire ends be rendered harmless and and that the cut edge be secured to prevent unwinding of the roll. Accordingly, it is customary to "tuck" the projecting sharp wire ends through interstices in the underlying layers of netting. This tucking operation performs two functions. First, the trailing or outer edge is securely affixed to the roll to prevent unwinding, and second, the dangerously sharp wire points are safely hidden within the body of the roll. Thus, tucking produces a securely formed firm roll that can be conveniently handled.

Inasmuch as each of the cut wire ends is individually tucked, the tucking operation is time consuming and substantially reduces the efficiency of the high speed forming machines which are stopped during tucking operations. In addition, individually tucked strand ends often come loose during shipment with resulting snagging between rolls. Although some attempts have been made to alleviate these problems, none has been successful.

The object of this invention, therefore, is to provide an efficient method for both securing the outer edges of rolls of mesh material and rendering harmless all the sharp wire ends thereon. It is a further object that the method be amenable to automation and to provide apparatus for practicing the subject method.

SUMMARY OF THE INVENTION

This invention is characterized by a method for rolling wire mesh material and securing and covering the outer end of the resulting roll. A measured quantity of wire mesh material, such as "chicken wire", is cut from a continuous supply of mesh material as might emerge from a forming machine. The measured quantity is rolled and one of the cut edges, comprised of a plurality of sharp cut wire points, then becomes an outer end. The outer end is securely fastened to the body of the roll to prevent unrolling and the sharp wire ends are covered for safety and to prevent snagging on other rolls during transit.

A preferred method of fastening and covering the wire ends includes the following steps. An area of the mesh material is located that will be adjacent to the outer end when rolling is completed. Next a strip of flexible material is applied to the inside of this area. After rolling is completed, another strip of similar material is applied to the periphery of the roll spanning the area covered by the first strip of material and enclosing the outer end of the roll. Thus, the cut edge and a portion of the layer of mesh material therebeneath are sandwiched between two strips of flexible material. The flexible material can be, for example, two strips of pressure sensitive adhesive tape that will interact through interstices in the mesh material thus securely sticking to each other and firmly holding the outer end in place. Or, the flexible material can be strips of thermoplastic material, in which case bonds are produced by piercing both strips with heated rods that pass through the interstices thus melting portions of the plastic and forming discrete bonds. It should be noted that this method is most efficient when used in conjunction with mesh material with large openings that provide substantial contact area between the flexible strips.

One feature of the method is the insertion of a wire between the flexible strips during packaging that facilitates opening as follows. The outer edge is securely fastened to the roll only if the flexible strips are firmly fastened together, but such firm cohesion makes removal difficult. When the subject wire is included in the packaging, and the time for unrolling has come, the wire is forcibly removed from between the flexible strips so as to pass between, and thus separate them. Consequently, the unrolling operation is performed more quickly and easily.

Another preferred method employs a strip of metallic material with large surface area malleable teeth projecting substantially perpendicularly therefrom. The strip is applied to the inside of an area that will be adjacent to the outer edge as was the first flexible strip in the preceeding method. Application is such that the teeth pass through interstices in the adjacent area and in the mesh material near the outer end and these project perpendicularly from the periphery of the roll. The rolling process is completed when a roller is passed over the periphery of the roll and bends the teeth down to cover the strand ends. When the teeth are bent the outer end and the adjacent area are clamped between the teeth and the metallic strip so that the edge is covered and securely fastened to the roll. This method is advantageous because the strips can be inexpensively manufactured and quickly applied, yet the final package possesses sufficient strength to secure netting made of coarse resilient wire. In addition, the large surface area of the teeth insures that the strand ends are covered, even if one end is displaced from its normal position.

According to another preferred method disclosed herein the fastening step includes tucking one or more of the strand ends into the roll to temporarily prevent unrolling. Packaging is completed by applying a heat shrinkable material over the periphery of the roll to enclose the outer edge of the adjacent portion of the roll therebeneath and applying heat to shrink the material until the roll of mesh material is tightly covered. The heat shrinkable material can be, for example, tubular heat shrinkable polyethylene film. A preforming step is particularly advantageous in this method to reduce unrolling stresses and thus reduce the possibility of strand ends piercing the film. When packaging with heat shrinkable tubing, the integrity of the finished package is unaffected by irregularities in the periphery of the roll of mesh material. Another important advantage of this method is that the entire cylindrical periphery of

the roll is covered by a plastic film. Thus, should one roll break open during shipment, snagging between rolls is still unlikely inasmuch as the interstices of other rolls are covered by a film.

DESCRIPTION OF THE DRAWINGS

These and other features and objects of the present invention will become more apparent upon a perusal of the following description taken in conjunction with the accompanying drawings wherein:

FIG. 1 shows a roll of wire mesh material including an outer end that is an edge which is comprised of a plurality of strnd ends;

FIG. 2 is a sectional view of a portion of a roll of wire mesh material similar to that shown in FIG. 1 wherein the outer end has been secured and the strand ends have been covered in accordance with the subject method;

FIG. 3 is an elevation view of a recommended apparatus for packaging rolls of mesh material as shown in FIG. 2;

FIG. 4 is a plan view of a portion of the apparatus shown in FIG. 3;

FIG. 5 is a sectional view of a tape clamp shown in the apparatus in FIGS. 3 and 4 taken along the lines 5—5;

FIG. 6 is a sectional view of another tape clamp shown in FIGS. 3 and 4 and is taken along the line 6—6;

FIG. 7 is a sectional view of a portion of a roll of wire mesh material wherein the outer edge and an area adjacent thereto are sandwiched between strips of thermoplastic material in accordance with another preferred method disclosed herein;

FIG. 8 is an isometric view of two rolls of wire mesh material covered with heat shrinkable tubing wherein the outer end has been secured by partial tucking and wherein one of the rolls has been subjected to heat in accordance with still another preferred method disclosed herein;

FIG. 9 is an isometric view of a toothed strip of flexible material utilized in conjunction with a method disclosed herein; and

FIG. 10 is a sectional view of a portion of yet another roll of wire mesh material that has been packaged by the method utilizing the strip shown in FIG. 9.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIG. 1 there is shown a roll 21 of a given length of mesh material 22 with an outer end 23 that is formed by an edge 24 which is defined by a plurality of wire strand ends 25 produced when the mesh is cut. The mesh material 22 can be, for example, wire fencing or poultry netting.

Referring next to FIG. 2 there is a sectional view of a portion of a roll 31 similar to the roll 21 shown in FIG. 1. An outer layer 32 is depicted by a plurality of strands generally parallel to the surface of the paper, only one 33 of which is visible, and a plurality of strands 34 generally perpendicular to the paper. Strand ends, only one 35 of which is visible, at the cut ends of the strands 33 form an outer end. An adjacent layer 36 of mesh material is depicted by strands generally parallel to the strand 33, only one 37 of which is visible, and by strands 40 that are generally parallel to the strands 34. Securing the outer end to the body of the roll 31 and covering the strand ends 35 is an outer strip of flexible pressure sensitive adhesive tape 38. To insure durability an inner strip 39 of adhesive tape is placed under the adjacent layer 36. Bonds 41 are formed between the strips 38 and 39 of adhesive tape in interstices in the wire mesh material. Thus, the two strips 38 and 39 are securely fastened together and enclose the outer end and an area of the adjacent layer 36. The roll 31 can be packaged manually as follows. The given length of mesh material is withdrawn from a source of supply and wound around an arbor or spindle to form the roll 31. When the desired length has been withdrawn, the strip is cut and thus the trailing edge and strand ends 35 are formed. Before rolling is completed, the area of the layer 36 that will be adjacent the strand ends 35 is located and the inner strip of tape 39 is applied thereto. When rolling is completed, the outer strip of tape 38 is applied so as to sandwich the outer end and the area of the adjacent layer 36. Alternatively, the method can be practiced automatically as, for example, with apparatus similar to that shown below. It should be noted that the two strips 38 and 39 of pressure sensitive adhesive tape are coextensive and secure and cover the entire outer edge of the roll 31.

Also visible in FIG. 2 is a removal wire 42 that is between the strips 38 and 39 and parallel thereto. When it is desired to open the package, the wire 42 is grasped and pulled out to separate the strips 38 and 39 in a manner similar to that in which the wrapper of an adhesive bandage strip is removed. The removal wire 42 greatly facilitates breaking of the bonds 41 which must exhibit a substantial cohesive force between the strips 38 and 39 to prevent inadvertent separation thereof.

Referring now to FIGS. 3, 4, 5 and 6 there is shown one preferred apparatus 51 for packaging rolls of mesh material as shown in FIG. 2. Referring first to FIG. 3, a strip 52 of mesh material is withdrawn from a source thereof (not shown) such as a forming machine. In the apparatus 51, the strip 52 passes through a supply apparatus including aligning rollers 53 and then through a cutter 54. A packaging apparatus 55 includes a first tape applicator 56 through which the strip 52 then passes. (The first tape applicator applies a strip of tape corresponding to the tape 39 in FIG. 2.) After passing a Teflon covered corner roller 57 the strip 52 enters a preformer 58 with Teflon covered rollers and emerges therefrom with a longitudinal curve. The curved strip 52 is then wound around an arbor or a spindle 59 forming a roll 61 like the roll 31 depicted in FIG. 2. The direction of winding is such that the curve impressed on the strip 52 by the preformer 58 reduces the unrolling stress. Near the spindle 59 is a second tape applicator 62 that is also part of the packaging apparatus 55. (The second tape applicator applies a strip of tape that corresponds to the tape 38 shown in FIG. 2.) When the desired length of mesh material 52 has passed through the cutter 54, a cut is made by forcing the two mating pieces of the cutter 54 together. The cut forms the edge defined by strand ends as described with respect to FIGS. 1 and 2. Thus, if the packaging apparatus were not activated, completion of the rolling process would yield a roll 61 with a loose outer end similar to the roll 21 shown in FIG. 1.

Mounting apparatus that supports a base plate 63 is not shown in order to preserve clarity. Extending vertically from the base plate 63 are two locating supports

64 (only one of which is visible in FIG. 3) that suspend the first tape applicator 56 at an elevation selected so that the distance between the first tape applicator 56 and the cutting apparatus 54 is equal to the circumference of the completed roll 61. Thus, the area 65 of the mesh material 52 that is within the first tape applicator 56 when the cut is made will ultimately be adjacent the outer end of the roll 61. Accordingly, the inner strip of tape denoted by the numeral 39 in FIG. 2 is applied to the area 65 simultaneously with the cutting operation.

Referring now to FIGS. 3 and 4 there is shown the first tape applicator 56. A closed frame is formed by a rear frame panel 66, two side frame bars 67 and 68 and a housing 69. Within the frame a platen 71 is supported from the rear frame panel 66 by three shafts 72, 73 and 74. Mounted on the platen is a block of resilient foam 75 with a Teflon facing 76. Four shafts 77 and 78 extending between the panel 66 and the housing guide reciprocating movement of a steel pressure plate 81. Also connected to the pressure plate 81 is a drive shaft 79 that is associated with a hydraulic cylinder 82 in the housing 69. When the cylinder 82 is activated the shaft 79 is forced out of the housing 69 thereby moving the pressure plate 81 toward the platen 71. The pressure plate 81 supports a block of resilient foam 84 with a Teflon facing 85, a lower activator 86, an upper activator 87 and a tape cutting blade 88. A cutting block 89 mounted on the platen 71 mates with the tape cutting blade 88. Between the Teflon faces 76 and 85 is stretched a strip of pressure sensitive adhesive tape 91 with its adhesive toward the pressure plate 81 and the area 65 of the mesh material 52. The direction of travel of the mesh material 52 is into the paper as shown in FIG. 4. As shown in FIG. 4, a notched belt 92 is supported by two pulleys 93 and 94 between the tape 91 and the Teflon face 76. However, as shown more clearly in FIG. 3, the belt 92, and in addition, a mating belt 95, are both vertically displaced from the platen 71. Thus, inasmuch as the Teflon faces 76 and 85 are forced together without interferences from the belts 92 or 95 when the hydraulic cylinder 82 is activated, the pressure sensitive adhesive tape 91 is forced against the area 65 of the strip 52. Note that the tape 91 does not stick to either Teflon face 76 or 85, yet does adhere to the wire in the mesh material 52. It will also be noted that simultaneously with the application of tape 91 to the mesh material 52 the cutting blade 88 and block 89 cut the tape 91 so that the portion of the tape 91 affixed to the mesh material 52 is detached from a roll of tape 96. A more detailed description of the first tape applicator 56, including an explanation of a tape transport mechanism that unwinds the tape 91 from the roll 96 and stretches and holds it parallel to the platen 71 will appear below. Currently, it can be assumed that the tape 91 is released from any tape transport mechanism after actuation of the first tape applicator 56. Thus, the strip of adhesive tape 91 (that corresponds to the strip 39 in FIG. 2) is affixed to the area 65 and is free to move therewith.

To recapitulate, at this stage of the process a given length of mesh material 52 has been supplied from a source and cut to form an outer end that is defined by a plurality of strand ends such as those shown in FIGS. 1 and 2. In addition, a strip of pressure sensitive adhesive tape 91 has been applied to the area 65 of the mesh material 52 that will ultimately be adjacent the outer end when the rolling process is completed.

The second tape applicator 62 includes, within a housing 97, an hydraulic cylinder similar to the cylinder 82. Operatively associated therewith is a drive shaft 98 visible in FIG. 3. A pressure plate 101 is supported by the shaft 98 and mounted thereon is a block of resilient foam 102 with a Teflon facing 103. In order to preserve clarity, a tape transport mechanism is not shown in the second tape applicator 62. It will be obvious however, that a transport mechanism similar to the tape transport mechanism in the first tape applicator 56 which will be described in detail below, could be employed to suspend a strip of pressure sensitive adhesive tape 104 parallel to the pressure plate 101 in the position shown in FIG. 3. Alternatively, the tape 104 can be manually positioned by an operator with the adhesive of the tape 104 toward the roll 61.

When the entire strip 52 is on the roll 61, the spindle 59 is stopped with the cut outer edge directly adjacent the tape strip 104 which has been either automatically or manually positioned. The strip of tape 91 on the underside of the mesh strip 52 also is directly adjacent the adhesive tape 104. Actuation of the second tape applicator 62 then forces the tape 104 against the roll 61 causing bonds to form between the adhesive of the tapes 91 and 104 through the interstices in the mesh material 52. The bonds formed are similar to the bonds 41 shown in FIG. 2. The resilient block 102 is important inasmuch as the tape 104 is forced through the interstices as portions of the soft block protrude therethrough. Thus, upon actuation of the second tape applicator 62 the outer end is secured to the roll 61 and the strand ends are covered. Consequently, the application of the pressure sensitive adhesive tape 104 constitutes a final packaging step and the roll 61 is then ready for shipment.

An explanation of the tape transport mechanism to be considered with particular attention paid to FIG. 4, follows. Around the periphery of the belt 92 are three equally spaced clamps 111, 112 and 113 each attached to both belts 92 and 95. As shown in FIG. 3, a stepping motor 114 is coupled to a shaft 115 that drives the pulley 93 and a lower pulley directly below the pulley 93 that operates in conjunction with the lower belt 95. The motor 114 is stepped and moves the belts 92 and 95 so that each clamp 111, 112 and 113 moves to the succeeding position immediately after actuation of the first tape applicator 56. Thus, when the drive shaft is retracted, if the clamps are in the position shown in FIG. 4, the clamp 113 is moved to the position shown as occupied by the clamp 111 and the clamp 111 is moved to take the place of the clamp 112 and so on. As shown in FIG. 4, the clamps 111 and 112 are in an open position. This position is seen in more detail with respect to the clamp 112 in FIG. 5. Also shown in FIG. 5 is the relative position of the strip of tape 91 to the open clamp 112. A rear element 116 is held in a vertical position by the belts 92 and 95 and a pivoting outer member 117 is held in the upper position indicated in FIG. 5 by a spring (not shown). A latch 118 at the lower end of the rear element 116 is held in an upper position as shown by FIG. 5 by a spring (not shown). However, application of force to either an upper ramp 119 or a lower ramp 121 will pivot the latch in a clockwise direction. Both the rear element 116 and the outer member 117 carry Teflon faces 122 and 123 respectively.

During actuation of the first tape applicator **56** the pressure plate **81** moves to the left as shown in FIG. **5** and thus the upper actuator rod **87** presses horizontally against the sloping upper surface **124** of the outer member **117**, thereby causing a clockwise rotation. Thus, the outer member is forced into a position parallel to the rear element **116** and the strip of tape **91** is held firmly between the Teflon faces **122** and **123**. As the pressure plate **81** is nearing the end of its stroke, a corner **125** of the outer member **117** strikes the upper ramp **119** thereby causing the latch **118** to rotate clockwise and receive the outer member **117**. As the Teflon faces **122** and **123** come together the latch snaps shut closing the clamp **112**. (This closed position is illustrated by the clamp **113** shown in FIG. **6**.) Thus, a referral to FIG. **4** shows that as the pressure plate **81** is forced toward the platen **71** and the tape **91** is severed by the cutting blade **88** what would become a free end of the strip of tape **91** is simultaneously gripped by the clamp **112**.

Referring now to FIG. **6** there is shown the clamp **113** gripping the tape **91** between two Teflon faces **131** and **132**. An outer clamp member **133** is being held against the rear element **134** by a latch **135**. Springs (not shown) apply bias forces to the latch **135** and the outer member **133** in a direction that would produce counterclockwise rotation therein.

Referring to FIG. **4** it is seen that the resilient pressure pad **84**, the upper actuator **87** and the strip of mesh material **52** are all displaced from the latch **113**. Thus, as the pressure plate **81** moves to the left as shown in FIG. **6** (or upward as shown in FIG. **4**) only the lower actuator **86** will come in contact with the clamp **113**. A lower ramp **136** receives the actuator **86** and interaction therebetween causes a clockwise rotation of the latch **135** and thus the outer member **133** is released. Upon release, the spring (not shown) causes the outer member **133** to rotate in a counterclockwise direction and assume the open position of the latch **112** in FIG. **5**. Thus, as the tape strip **91** is pressed against the area **65** and affixed thereto the end of the tape is released. The adhesive of the strip of tape **91** does not stick to either Teflon face **131** or **132** but does stick to the mesh **52** and is carried thereby toward the roll **61**.

During operation of the apparatus **51** the strip of mesh material **52** is affixed to the spindle **59** and the rolling process is started. When the total length of the mesh material **52** between the cutter **54** and the roll **61** and the material in the roll **61** equals the desired final length of the roll, the spindle **59** is stopped. Then the cutter **54** cuts the mesh material **52** so as to form an edge defined by the strand ends. Simultaneously, the two Teflon faces **76** and **85** are forced together, thereby affixing the strip of flexible pressure sensitive tape **91** to the area **65** of the mesh material. As the tape **91** is affixed to the area **65** the clamp **113** releases the end of the tape and the cutting blade **88** cuts the tape. Thus, the strip of tape **91** that is applied to the area **65** is released from the roll **96** and can move freely with the mesh material **52**. Also, what would have been a free end of the tape **91** near the cutting blade **88** is grasped by the clamp **112**. The spindle **59** is again started to complete the rolling process. As the spindle is restarted the stepping motor **114** turns the belts **92** and **95** so that the clamp **112** is moved to the position of the clamp **113** in FIG. **4**. Thus, another strip of tape **91** is unwound from the roll **96** and held parallel to the platen **71** ready to be applied to the next given length of mesh material **52**. When the entire given length of mesh material **52** is on the roll **61** the spindle **59** is stopped with the tape **91** adjacent the tape **104**. As mentioned previously, the adhesive surfaces of the tapes **91** and **104** are now facing. Thus, upon actuation of the second tape applicator **62** the adhesive surfaces are forced together creating the sandwich package that is shown in FIG. **2**. The roll **61**, which is now a finished package, is removed from the spindle **59** and shipped. A new leading edge of mesh material **52** is then attached to the spindle **59** and the process is repeated.

Referring now to FIG. **7** there is a sectional view of a portion of a roll **141** of mesh material **142** including an outer layer **143** with an outer edge **144** that is defined by a plurality of strand ends, one **145** of which is visible in FIG. **7**. Next to the outer end **144** is an area **146** of an adjacent layer **147**. The fastening and covering steps of the method depicted in FIG. **7** are combined into a single packaging step that is performed by placing an inner strip of thermoplastic material **148** on the inner side of the area **146** during the rolling process and placing an outer strip of similar plastic **149** on the periphery of the roll **141** so as to be coextensive with the inner strip **148**. The elongated strips **148** and **149** run perpendicularly to the paper as viewed in FIG. **7**. Penetration of both strips of thermoplastic **148** and **149** with heated metal rods so as to melt the thermoplastic material and form small plastic "bridges" or bonds **151** between the strips completes the process. The bridges **151** extend through interstices in the wire mesh material **142**. Thus, this method is similar to the method utilizing the two strips of tape depicted in FIG. **2** and can be performed by hand or by automated equipment similar to that shown in FIGS. **3** and **4**.

Referring now to FIG. **8** there is shown a roll **153** of mesh material similar to the roll **21** shown in FIG. **1**. An outer edge has been fastened to the body of the roll **153** by tucking one **155** or more of the strand ends **156** into the roll. Only so many of the strand ends **156** as are necessary to temporarily fasten the outer edge are tucked. The roll **153** is next covered by a tubular heat shrinkable material **154** either manually or by suitable packaging machinery. For example, the material can be heat shrinkable polyethylene film. A conveyor belt **157** carries the roll **153** and film **154** to an oven **158** where heat is applied causing the film **154** to shrink and tightly cover the roll **153** thereby securing the outer edge and covering the strand ends **156**. A finished roll **153***a* is shown emerging from the oven **158** covered by a shrunken plastic film **154***a*. Obviously, preforming is advantageous in the practice of this method inasmuch as unrolling stresses are thereby reduced to lessen the possibility that a strand end **156** will pierce the film **154**. Rolling and cutting apparatus similar to that in FIG. **3** can be used advantageously with this method or manual rolling and cutting can be performed.

Referring next to FIGS. **9** and **10** there is depicted yet another method of packaging a roll **165** of wire mesh material **166**. A strip of metallic material **167** is cut so as to form wide teeth **168** with relatively small spaces therebetween. A 90° bend is made along a fold line **169** so that the teeth **168** are perpendicular to a base surface **171**. On the roll **165**, an outer end **172** of the wire mesh material **166** is defined by a plurality of wire strands **173**. Adjacent the outer end **172** is an adjacent

layer **174**. Application of the fastener strip **167** is begun by inserting the teeth **168** through interstices in the adjacent layer **174** during the rolling process. Upon completion of the rolling, the teeth **168** protrude through interstices near the outer end **172** and extend perpendicularly from the roll **165** as shown in phantom in FIG. **10**. A roller (not shown) is passed over the periphery of the roll **165** to bend the teeth **168** to the position shown in FIG. **10** thereby fastening the outer end **172** to the adjacent layer **174** and covering the strand ends **173**. As a diagram for clarity only, one strand end **175** and one tooth **176** are shown in phantom in FIG. **9** with the tooth bent so as to cover the strand end **175**.

Obviously, many modifications and variations of the present invention are possible in light of the above teachings. For example, the method depicted in FIG. **2** could utilize water activated or heat sensitive adhesive material. It is to be understood, therefore, that the invention can be practiced otherwise than as specifically described.

What is claimed is:

1. A method for rolling mesh material and securing the outer end thereof and comprising the steps of:

withdrawing a given length of wire mesh material from a source supplying a strip thereof;

cutting through said strip of mesh material so as to separate therefrom said given length and form thereon an edge comprised of a plurality of strand ends;

rolling said given length to form a roll with said edge as an outer end;

fastening said edge to said roll so as to prevent unrolling thereof; and

applying a material to said roll so as to cover said strand ends.

2. A method according to claim **1** further comprising a step of preforming said mesh material to impart a longitudinal curve thereto to reduce unrolling stresses.

3. A method according to claim **1** wherein said fastening step includes fastening the full length of said edge to said roll.

4. A method according to claim **1** wherein said fastening step and said applying step comprise a simultaneous packaging step.

5. A method according to claim **4** wherein said fastening and applying steps comprise locating an area of said mesh material that will be adjacent said edge when said rolling is completed, applying to the inner surface of said area a strip of flexible material with a first surface that is in contact with said inner surface; applying to the periphery of said roll a second strip of flexible material with a second surface so that said second strip spans said area and covers said strand ends and creating a bond between said second surface and said first surface through interstices in said mesh material.

6. A method according to claim **5** including the step of inserting between said first and second surfaces a removal means that can be actuated to break said bond and release said edge.

7. A method according to claim **5** wherein both of said surfaces comprise pressure sensitive adhesive.

8. A method according to claim **5** wherein said flexible materials comprise strips of thermoplastic material and said bonds are created by applying heat to said thermoplastic material.

9. A method according to claim **4** wherein said material comprises a strip with clamping means projecting therefrom; and said packaging step comprises the step of locating an area of said mesh that will be adjacent said edge when rolling is completed, positioning said strip over said area with said clamping means projecting through interstices therein, displacing said clamping means so as to clamp said outer end to said area and cover said strand ends.

10. A method according to claim **9** wherein said strip is metallic and said clamping means comprise teeth projecting therefrom; and said displacing step comprises bending said teeth over said strand ends.

11. A method according to claim **10** wherein said positioning step comprises disposing said strip over the inner surface of said area with said teeth projecting through interstices in said area and through interstices directly adjacent said edge.

12. A method according to claim **4** wherein said packaging step comprises sandwiching said edge between a layer of mesh material adjacent thereto and a strip of pressure sensitive adhesive tape.

13. A method according to claim **4** wherein said packaging step comprises enclosing said edge and an adjacent portion of said mesh material in plastic material.

14. A method according to claim **1** wherein said fastening step comprises tucking one of said strand ends into the roll of mesh material and said applying step comprises applying said material around a periphery of said roll and over said edge.

15. A method according to claim **14** wherein said material is heat shrinkable and said applying step comprises applying heat to cause said material to shrink tightly over said edge.

16. A method according to claim **15** wherein said heat shrinkable material is tubular and encloses said roll of mesh material.

17. A method according to claim **16** wherein said heat shrinkable material comprises polyethylene film.

18. Apparatus for rolling mesh material and securing the outer end thereof and comprising:

supply means for supplying a strip of mesh material;

cutting means for separating a given length from the strip of mesh material so as to form an edge defined by a plurality of strand ends;

spindle means for rolling said given length to form a roll with said edge as an outer end; and

packaging means for applying to said edge a material that covers said strand ends.

19. Apparatus according to claim **18** including a preformer means for imparting a longitudinal curve to said given length so as to reduce unrolling stresses.

20. Apparatus according to claim **18** wherein said packaging means comprises locating means for locating an area of said given length that will be adjacent to said edge when rolling is completed, first applicator means for applying a first flexible strip of material with a first surface to the inside of said area, second applicator means for applying a second strip of flexible material with a second surface to the periphery of said roll so that said second strip covers said edge and said first surface and bonding means to bond said second surface to said first surface through interstices in said area of said given length.

21. Apparatus according to claim **20** wherein both of said interactive surfaces comprise pressure sensitive

adhesive and said bonding means comprises pressure means.

22. Apparatus according to claim 18 wherein said material is heat shrinkable and said apparatus further comprises heating means for heating said material.

23. Apparatus according to claim 22 comprising a preformer means for imparting a longitudinal curve to said given length so as to reduce unrolling stresses.

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