Nov. 5, 1963 G. L. RAYMOND ETAL 3,109,277

GARLAND FORMING APPARATUS AND METHOD

Filed April 26, 1962 3 Sheets-Sheet 1

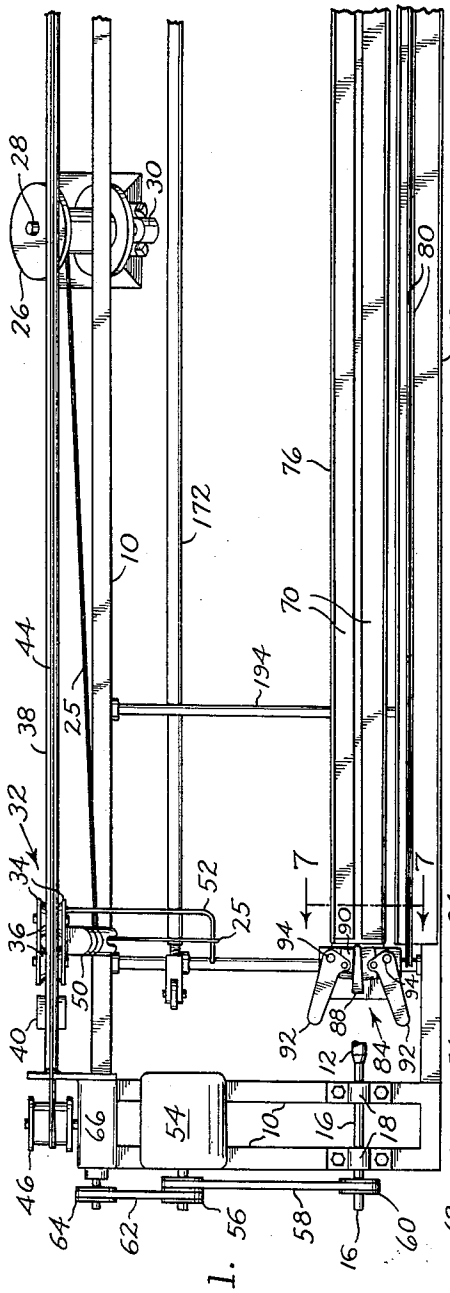


Fig. 1.

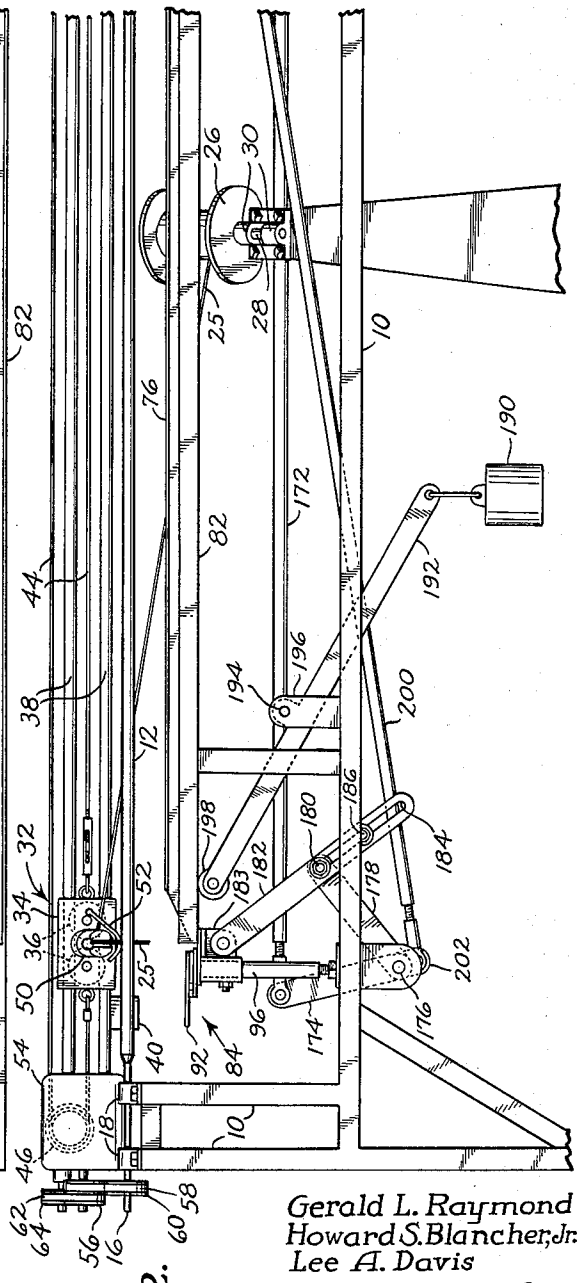


Fig. 2.

Gerald L. Raymond
Howard S. Blancher, Jr.
Lee A. Davis
INVENTORS

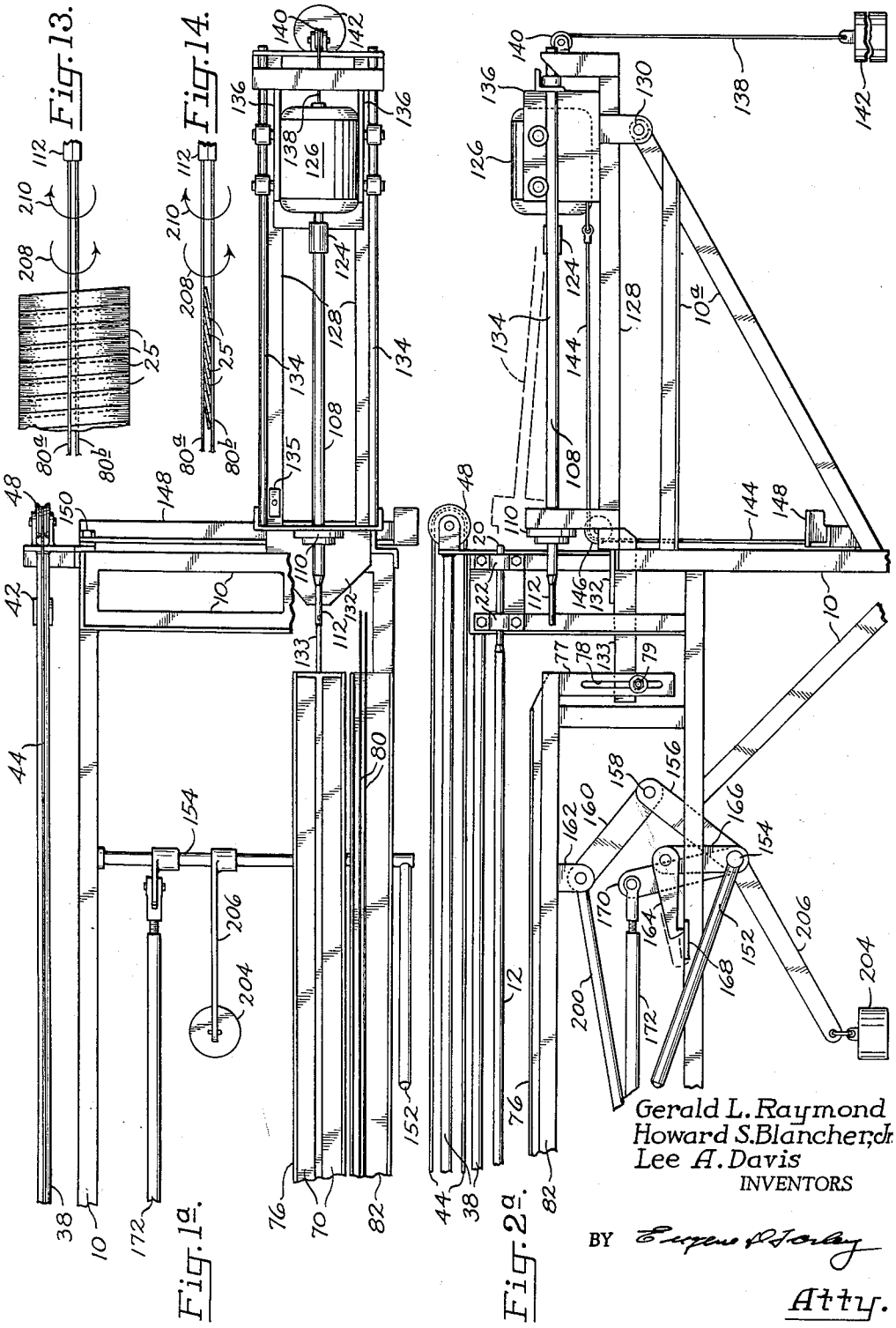
BY Eugene D. Farley

Atty.

Nov. 5, 1963 G. L. RAYMOND ETAL 3,109,277

GARLAND FORMING APPARATUS AND METHOD

Filed April 26, 1962 3 Sheets-Sheet 2



Nov. 5, 1963 G. L. RAYMOND ETAL 3,109,277

GARLAND FORMING APPARATUS AND METHOD

Filed April 26, 1962 3 Sheets-Sheet 3

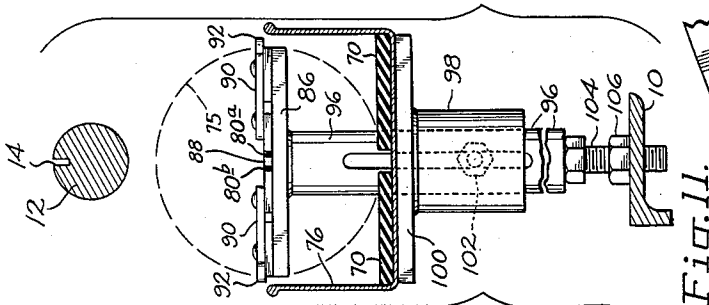


Fig. 11.

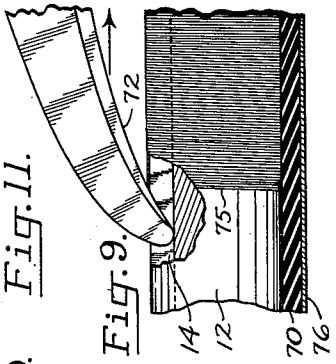


Fig. 9.

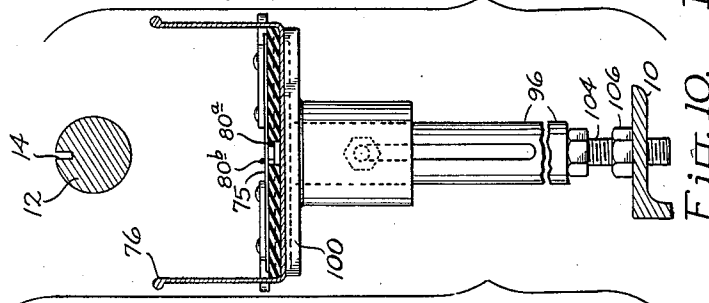


Fig. 10.

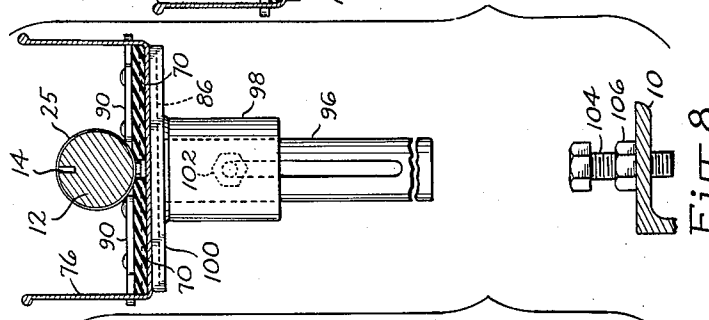


Fig. 8.

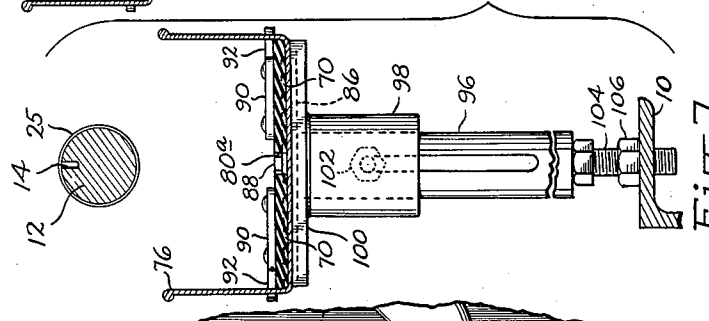


Fig. 7.

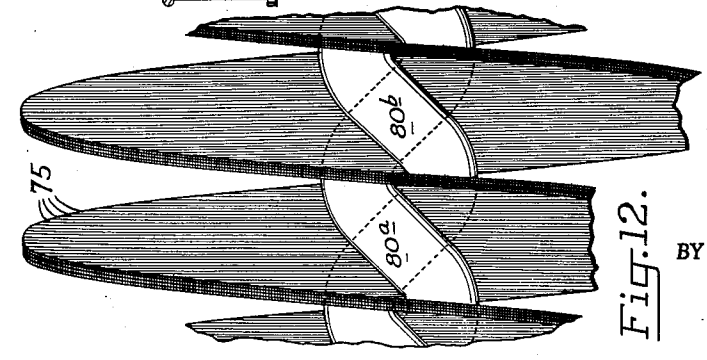


Fig. 12.

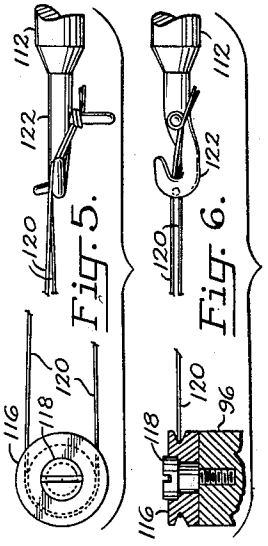


Fig. 5.



Fig. 6.

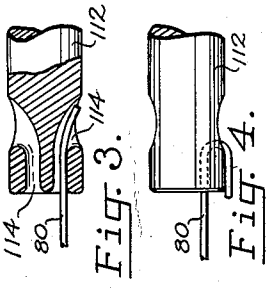


Fig. 3.



Fig. 4.

Gerald L. Raymond
Howard S. Blancher, Jr.
Lee A. Davis
INVENTORS

BY Eugene O. Farley

Atty.

United States Patent Office 3,109,277 Patented Nov. 5, 1963



3,109,277

# GARLAND FORMING APPARATUS AND METHOD

Gerald Lyle Raymond, 12224 Nyanza Road, and Howard Sherman Blancher, Jr., Rte. 2, Box 594, both of Tacoma, Wash., and Lee A. Davis, 423 2nd NE., Apt. 6A, Puyallup, Wash.

Filed Apr. 26, 1962, Ser. No. 190,304
17 Claims. (Cl. 57—24)

The present invention relates to method and apparatus for securing filamentous strands between intertwisted wires to form lengths of decorative material termed herein "garlands," used in the manufacture of Christmas trees, wreaths and the like.

It is the general object of the present invention to provide method and apparatus for confining between intertwisted wires a multiplicity of radiating fiberglass or other filamentous strands arranged uniformly about the wires, producing highly decorative and beautiful garlands of substantial length.

It is another important object of the present invention to provide method and apparatus for producing such garlands at a high production rate and with maximum efficiency in spite of the difficulty of handling bulk quantities of finely divided material such as fiberglass.

Still a further object of the invention is to provide a method of forming garlands by intertwisting clusters of fiberglass or other filamentous strands between wires or other stiffly flexible elements in a manner such as to produce maximum distribution of the strands along the length of the elements while at the same time securing the strands effectively thereto.

In the drawings:

FIGS. 1 and 1*a* are interrupted plan views of the presently described garland forming apparatus;

FIGS. 2 and 2*a* are interrupted views in elevation thereof;

FIGS. 3 and 4 are detail fragmentary views in section and elevation, respectively, of the means employed for attaching wires to be intertwisted to a rotating shaft;

FIGS. 5 and 6 are fragmentary views in plan and elevation respectively, FIG. 6 being partly in section, illustrating the means employed for attaching the wire when relatively flexible wire is employed as the base material;

FIGS. 7, 8, 10 and 11 are fragmentary, transverse, sectional views, taken along line 7—7 of FIG. 1 and illustrating various stages in the strand forming and intertwisting procedure of the invention;

FIG. 9 is a fragmentary view in side elevation, partly in section, illustrating the manner of cutting the filaments into strands to be used in the sequence illustrated in FIGS. 7, 8, 10 and 11;

FIG. 12 is a fragmentary, enlarged view illustrating the construction of a finished garland produced by the presently described method and apparatus; and

FIGS. 13 and 14 are schematic views in plan and side elevation, respectively, illustrating the proper technique for twisting the wires when securing the fiberglass or other strands between them.

Broadly considered, the garland forming apparatus of the present invention includes a mandrel adapted to be wound spirally with filaments of material and, when wound, to be traversed longitudinally with a cutter for cutting the filaments, forming a multiplicity of strands of the material lying flat, side by side, transversely of the mandrel. A bearing means comprising a pair of spaced bearing strips is positioned adjacent the mandrel, parallel thereto.

Grip means are stationed at one end of the bearing means for gripping the ends of a pair of wires or other stiffly flexible members extending the length of the bearing means, one on each side of the strands.



Twisting means are located at the other end of the bearing means for engaging the other end of the wires and intertwisting them as required to secure the strands between the wires.

To facilitate these operations, the bearing means is provided with mounting means which is shiftable between three positions: a loading position wherein the bearing means is maintained spaced from the mandrel for receiving the wires; a filament-cutting position wherein the bearing means bears against the filaments securing them against displacement as they are cut into strands; and a twisting position wherein the bearing means is removed from the filaments progressively along the length of the mandrel as required to permit intertwisting of the wires without disarrangement of the filaments.

The present invention also comprehends the novel method of forming garlands which broadly comprises placing clusters of fiberglass or other strands transversely along the length of a wire or other stiffly flexible member in horizontal position, the clusters being arranged substantially parallel to each other with their adjacent side margins overlapped in shingled relationship, superimposing a second wire or other stiffly flexible member substantially parallel to the first but laterally offset therefrom and on the opposite side of the strands, and intertwisting the stiffly flexible members starting at one end thereof. The twisting operation is carried out in the angular direction of cooperative support of the clusters by their overlapped margins, thereby locking the strands between the intertwisted wires in the most effective way possible, without disarranging the strands as they are gripped by the wires, and distributing them uniformly along the length of the same.

The apparatus of the invention, broadly described above, basically consists of three units: a spinning unit, a work holding and twisting unit, and a shifting unit.

*The Spinning Unit*

The spinning unit has for its general function cutting a filamentous material such as fiberglass roving into a multiplicity of strands of substantially equal length, thereby providing a strand supply for the twisting unit. Its construction is shown in FIGS. 1, 1*a*, 2 and 2*a*.

The spinning unit is mounted on a frame **10**. It includes a mandrel **12** provided with a longitudinal slot or groove **14** which serves as a guideway for a knife used in cutting the filaments, as will appear later.

Mandrel **12** has a circumference substantially equal to the length of the strands it is desired to produce. It is formed at its ends with sections of reduced diameter forming shaft **16** journaled in bearings **18**, and shaft **20** journaled in bearings **22**.

Fiberglass roving or other filamentous material **25** to be wound around the mandrel is supplied on a spool or reel **26**, the lower end of which is provided with a shaft **28** rotatably mounted in bearings **30**.

The reel is mounted at an angle suitable for feeding the filamentous material to a traveling carriage **32** which travels in a linear path adjacent and parallel to the mandrel.

Carriage **32** comprises a pair of vertical plates **34** rotatably mounting between them a pair of wheels **36**. The wheels, in turn, track on rails **38** adjacent which are located limit switches **40**, **42** which limit the travel of the carriage. Connected to the carriage are the ends of a continuous drive cable **44** reeved about a driven pulley **46** and an idling pulley **48** at opposite ends of the apparatus.

A pair of guides for the filamentous material being fed to the mandrel are mounted on the inner one of carriage plates **34**. The first guide **50** conveniently may comprise a porcelain body having therethrough an opening suitably

dimensioned to pass the feed material. The second guide 52 comprises an arm extending outwardly from the carriage plate and bent at right angles to form a U-shaped guidesection spaced from guide 50 but substantially aligned therewith and designed to receive and guide the filamentous material as it passes to the mandrel.

Drive means are provided for driving in unison, from a common source, both moving components of the spinning unit, i.e. mandrel 12 and carriage 32.

To this end a motor 54 is mounted on the frame. Its shaft drives a double pulley 56, one side of which drives a belt 58 which, in turn, drives a pulley 60, keyed to shaft 16 of the mandrel. The other side of pulley 56 drives a belt 62 which engages pulley 64 fixed to the shaft of a gear box 66. The latter in turn drives pulley 46 which actuates drive cable 38.

Motor 54 is in an electric circuit with limit switches 40, 42 and drives mandrel 10 at a speed correlated with the speed of travel of carriage 32 so that the filamentous material is wound uniformly about the mandrel from one end to the other.

*The Work Holding and Twisting Unit*

The work holding and twisting unit has for its general function holding strands cut from the filament wound about the mandrel, as described above, gripping a pair of wires or other stiffly flexible members in proper relation to each other and to the strands; and intertwisting the wires for securing the strands between them.

For holding the filamentous material and the strands produced therefrom during the cutting operation, there is provided bearing means comprising a pair of spaced apart, elongated bearing strips 70 extending the length of the winding on mandrel 12, substantially parallel to the mandrel. The bearing strips preferably comprise compressible rubber pads spaced apart sufficiently to receive a wire or other stiffly flexible member and designed to bear against the undersurface of the filamentous winding on the mandrel along its entire length, holding its securely so that when a cutting tool such as knife 72 of FIG. 9 is applied, cutting the continuous, spirally-wound filamentous material 25 into strands 75, neither the filamentous material nor the strands will be disarranged during the cutting operation. As a result, the strands are cut uniformly to length and positioned side by side in more or less parallel biased arrangement, transversely across bearing strips 70.

The bearing strips are suitably supported and housed, preferably in a trough 76 having a flat bottom and angularly bent side walls spaced apart a distance which is substantially the same as the length of the cut strands. The trough thus serves a forming function in that it maintains the ends of the strands aligned as required to insure that the finished garlands will be of uniform contour and dimensions.

The trough in turn is mounted on shifting means for shifting its vertical position with reference to mandrel 12, as will appear hereinafter. Depending from its right hand end, as viewed in FIG. 2*a*, is a vertically arranged bar 77 in which there is cut a longiutdinal slot 78. A bolt 79, which serves as an adjustable stop, works in the slot.

Gripping means also are present for gripping the ends of wires or other stiffly flexible members to be twisted together about strands 75. The wires, indicated at 80, may be contained in a storage tray 82 and placed one at a time in the space between bearing members 70, where the selected wire will be positioned beneath strands 75 as they are cut from mandrel 12.

In their illustrated form (FIGS. 1 and 2), the grip means employed comprises a lever operated wedge unit, indicated generally at 84, and accommodating two wires.

The wedge unit is supported on a plate 86 (FIG. 11) welded to an extension of the bottom of trough 76 and supporting a centrally located wedge block 88 on each side of which are mounted cooperating, lever-operated grips. These may be identical in construction, each comprising a gripping element 90 pivotally mounted on a lever arm 92, the lever arm in turn being pivoted to supporting plate 86 by means of pin 94.

It will be apparent that when the end of a wire located between bearing strips 70 is placed in the space between wedge block 88 and one of grip elements 90, the corresponding lever 92 may be actuated to press the wire against the wedge block, releasably securing it in position.

Since as indicated before, trough 76 is shiftable between various vertical stations, means are provided for mounting grip unit 84 in such a manner that it may be maintained at all times in proper relation to trough 76.

Accordingly plate 86 is fixed to the end of a longitudinally slotted post 96 which is received slidably in a sleeve 98 supported by an extension 100 of the bottom of trough 76. A bolt 102 extends through sleeve 98, working in the slot in post 96 making in effect a collapsible thrust shaft of the post.

The lower end of post 96 is supported in selected positions of vertical adjustment by the head of a bolt 104 working in a nut 106 which is fixed to a frame member 10. Accordingly, by adjustment of bolt 104 the rest position of post 96, and hence of grip unit 84, may be determined.

Means also are provided for holding and supporting the other (right hand) ends of wires 80.

A rotatable shaft 108 is journaled in a bearing 110 and provided with an axial extension 112. The end of the extension is provided with a pair of passageways 114 dimensioned to receive the end of a wire 80 (FIGS. 3 and 4). Thus the end of the wire can be inserted in the passageway, led through to the exterior, and reversely bent, securing the wire to the extension.

Alternate means for gripping and mounting the wire is illustrated in FIGS. 5 and 6. The illustrated arrangement is applicable to wire of relatively small gauge which is flexible and accordingly can be bent and formed relatively easily.

Replacing grip unit 84 at the left hand end of the apparatus is a simple spool or circular guide 116 which may be attached to the upper end of post 96 by means of a bolt 118 threaded into the latter. A flexible wire 120 then may be looped about the spool and its ends secured to a hook-and-pin member 122 extending outwardly from extension 112.

Thus the wire may be placed around spool 116, pulled tight, and its ends secured to the hook-and-pin unit in the illustrated manner.

Rotary drive means are provided for shaft 108, making it possible to intertwist the two wires. Accordingly, shaft 108 is coupled through coupling 124 with the aligned shaft of motor 126 arranged to serve three functions.

First, it is adjustable toward and away from trough 76 as required to insert the ends of the wires in the openings in shaft extension 112 and then to maintain the fastened wires under tension.

Second, it is adjustable toward the trough as required to accommodate shortening of the wires as they are twisted together.

Third, it is adjustable angularly as required to maintain the end of shaft extension 112 substantially level with the trough as the latter is shifted to an elevated position.

Such arrangement of the motor is accomplished by pivoting to an extension 10*a* of frame 10 a motor frame 128 connected to one end of frame extension 10*a* by pivot pins 130. A horizontal plate 132 extends outwardly from the other end of the motor frame and rests upon frame 10. A tongue 133 extends forwardly from the motor frame, below the plate, and bears against stop bolt 79 in bar 77.

The motor frame supports a pair of longitudinally-extending, spaced tracks 134 along which runs a wheeled carriage 136 upon which motor 126 is mounted.

A limit switch 135 is fastened to the motor frame adjacent the end of tracks 134. This switch is in an electric circuit with motor 126 and is positioned for contact by carriage 136 when the carriage has reached a predetermined limit of forward travel.

Carriage 136 is maintained normally in its retracted position of FIGS. 1*a* and 2*a* by attaching it to one end of a cable 138. The cable passes over a pulley 140 fastened to the rear of the sub-frame. Its other end is connected to a weight 142 of predetermined size.

Means also are provided for securing limited advancement of carriage 136, as when loading shaft extension 112. The means employed for this purpose comprise a cable 144 attached at one end to the forward end of motor carriage 136 and passing about a pulley 146 rotatably mounted on the forward end of motor frame 128. The other end of the cable is fastened to an intermediate position on a foot-operated lever 148, the inner end of which is pivoted to the frame by pin 150.

By depressing foot lever 148, it is possible to advance motor carriage 136 against the force exerted by weight 142 sufficiently to load shaft extension 112.

Upon twisting the wires fastened to shaft extension 112, the motor carriage advances with shortening of the wires until the predetermined degree of twisting has been accomplished, as indicated by contact of the carriage with limit switch 135.

By lifting on tongue 133 it is possible to pivot motor frame 128 about pin 130, adjusting shaft 134 angularly as required to maintain its extension 112 in proper vertical relationship to trough 76.

Thus, all three adjustments of the motor and its supporting carriage are made possible.

*The Shifting Unit*

As indicated above, the presently described apparatus is so constructed that trough 76, bearing strips 70 and grip unit 84 all may be shifted together between three operating positions. In the first, or loading position, the bearing means is maintained spaced from the mandrel for receiving the wires.

In the second, or filament-cutting position, the bearing means is adjusted to bear against the filaments securing them against displacement as they are cut into strands.

In the third, or twisting position, the bearing means is removed from the strands during intertwisting of the wires, the removal being accomplished sequentially from one end of the bearing means to the other so as not to release the strands until they have been secured between the twisting wires.

The shifting unit employed for accomplishing these operations is illustrated in FIGS. 1, 1*a*, 2 and 2*a*. The operating positions are illustrated in FIGS. 7, 8, 10 and 11.

Shifting of the trough assembly is accomplished by operation of a crank lever 152 fixed to one end of a crank shaft 154 extending transversely of the apparatus. A first crank 156 is rigid to the crank shaft and pivotally connected through pin 158 to one end of a link 160. The other end of the link is pivotally connected to tabs 162 fastened to the underside of trough 76. Adjustment of crank lever 152 thus operates crank 156 and links 160 as a jack, raising and lowering the trough.

The trough then may be latched in its elevated position, if desired, by means of a latch 164 pivoted to an arm 166, also rigid to crank shaft 154. Latch 164 is positioned for engagement with a latch bar or keeper 168 the position of which is such that the latch drops into locking position when trough 76 has been shifted to its filament-cutting position, wherein the bearing means bears against the filaments.

The jack action of crank 156 and link 160 is transmitted to the other side of the unit by means of a second crank lever 170, one end of which is fixed to crank shaft 154 and the other of which is pivotally connected to an



adjustable thrust or tie bar 172 extending to the other side of the unit.

The thrust bar interconnects crank arm 170 and a second crank arm 174 which is rigid to a second crank shaft 176 extending transversely of the unit, parallel to crank shaft 154.

Another crank arm 178 is fixed at an angle to crank shaft 176 and pivotally interconnected through pin 180 to a link 182. The end of this link is pivoted to a tab 183 which, in turn, is fixed to the side of sleeve 98 mounting one end of trough 76.

Crank arm 178 and link 182 bear the same angular relationship to each other as do crank arm 156 and link 160 on the opposite side of the apparatus. Accordingly, they, too, serve a jacking function for raising and lowering one end of the rough in unison with the other end thereof.

Delay means are incorporated in the crank arm 178, link 182 combination, however, to permit lowering the right hand end of the trough, as viewed in the drawings, while still retaining the left hand end elevated as required to retain bearing strips 70 in contact with the strands until they have been secured by the intertwisting wires, the intertwisting obviously occurring progressively from the right side to the left side of the apparatus.

To this end, link 182 is provided in elongated form, pivot pin 180 being mounted in the mid section of the link. The lower section of the link then is provided with a slot 184 in which adjustably is positioned a stop 186. Pivot pin 180 works in slot 184. Therefore, the left hand end of trough 76 may be maintained in a position of elevation with respect to the right hand end thereof, determined by the degree of extension of link 182 with respect to pin 180.

The link is urged resiliently toward an extended position, and the left end of the trough accordingly normally urged toward an elevated position, by the application of a weight 190 linked to one end of a lever 192 fulcrumed intermediate its ends on a pin 194 supported on standards 196. The other end of lever 192 rotatably mounts a roller 198 which bears against the under side of trough 76, urging it toward an elevated position, and urging link 182 to an extended position.

Also included in the shifting assembly is a swaybar, one end of which is connected to tabs 162 at one end of the unit, and the other end of which is connected to an arm 202 on crank shaft 176 at the other end of the unit. This bar stabilizes the trough against endwise movement as it is shifted between its various vertical positions.

To facilitate shifting of the unit, a counterweight 204 is provided. This member is linked to one end of a lever 206, the other end of which is fixed to shaft 154. The magnitude of the weight is predetermined so that it normally maintains the entire unit in its loading position of FIGS. 1 and 2, with latch 164 in unlatched position.

*Operation*

The operation of the presently described apparatus is as follows:

In operating the apparatus, three fundamental procedures are coordinated with each other. These are the spinning procedure, whereby filamentous material is wound about mandrel 12; the strand forming procedure, whereby the filamentous materal is cut into strands; and the intertwisting procedure whereby the strands are locked in place between twisted wires, radiating outwardly in all directions.

In the spinning stage, a reel 26 of fiberglass roving consisting of a multiplicity of tiny filaments of fiberglass, or other suitable filamentous material, is placed on spindle 28. The roving is threaded first through guide 50 and then through guide arm 52 of spinning carriage 32. Its end then is wrapped around one end of mandrel 12.

Motor 54 then is energized. This drives the mandrel through belt 58, and also the carriage through belt 62

and gear box 66, the two units being driven synchronously at predetermined relative rates so that uniform winding of the roving about the mandrel is achieved. This results in building up a spiral wrapping about the mandrel, the turns of the roving overlapping sufficiently to cover the mandrel but not so much as to build up too thick a wrapping on it.

At the end of its traverse, carriage 32 strikes one or the other of limit switches 40, 42, shutting off motor 54. During the spinning operation, forming trough 76 is in the loading position of FIGS. 1, 2 and 7, conveniently spaced from the mandrel, with latch 164 in its idle location.

Next, the underlying wire 80*a* shown in FIG. 7 is stretched in the bottom of trough 76, between bearing pads 70, ready to receive the filamentous strands. Accordingly, one of the wires 80*a* removed from storage trays 82 is placed between the pads and its left hand end inserted in the space between wedge block 88 and lever-operaed wedging element 90. Lever 92 then is operated to grip the end of the wire securely.

The right hand end of the wire then is inserted in passageway 114 of shaft extension 12 as shown in FIG. 3. Foot lever 148 is depressed, advancing motor carriage 136 forwardly so that the wire passes completely through the passageway and can be bent reversely as shown in FIG. 4. Removal of the operating pressure from foot lever 148 then applies to the wire the full pressure of weight 142, thus tensioning the wire.

It will be noted that as the trough is elevated to the filament-cutting position of FIG. 8, stop bolt 79 which engages tongue 133 of the motor-supporting sub-frame 128 tilts the latter about pin 130 until it assumes an angularly adjusted position, indicated in dotted outline in FIG. 2*a*, wherein shaft extension 112 is maintained substantially opposite the end of the trough. This avoids kinking of wire 80*a*, which is stretched taut between shaft extension 112 and grip unit 84 in the space between bearing pads 70.

In the next step, the spirally wrapped roving is cut to divide it into strands 25 of uniform length, which are to be used as the decorative material in producing the garlands. Particularly in view of the fine, filamentous material of the roving, it is necessary to restrain each spiral wrapping, and also to contain the cut strands, so that complete disarrangement will not result. This purpose is achieved by the application of bearing means against the wrappings and carrying out the cutting operation in a forming trough 76 having a width substantially equal to the length of the cut strands, i.e. substantially equal to the circumference of mandrel 12.

Accordingly, for the cutting operation the trough assembly is moved, by pressing down on crank lever 152, moving cranks 156, 178 synchronously, since they are tied together by thrust rod 172. The result is to jack trough 12 upwardly until resilient, spaced bearing strips 70 contained therein bear firmly against the underside of the wound mandrel, as shown in FIG. 8. At the same time, latch 164 engages latch bar 168 holding the trough in its elevated position so that the cutting operation of FIG. 9 may be consummated.

This consists merely of running a knife or other cutting member 72 along slot 14 of the mandrel, severing the windings of the roving. Thereupon the resulting strands 25 straighten out and lie flat on the bottom of the trough.

In the next operation a second wire 80*b* is superimposed above the cut strands and stretched between the wire supporting members.

To accomplish this purpose latch 164 is released from the dotted line, engaged position of FIG. 2*a*, whereupon the forming trough and its supporting lift assembly gravitate downwardly to the intermediate position of FIGS. 2 and 10 where they are maintained by counterweight 204. During this adjustment, the upwardly-angled motor assembly is lowered to its horizontal full line position in which shaft 134 is substantially aligned with the wire.

Wire 80*b* then is removed from tray 82. One end of this wire is secured between wedge block 88 and the companion lever-operated wedging element while the other end is inserted through the vacant one of passageways 114 in shaft extension 112. The wire then is pulled tight manually and reversely bent so that both wires now are strung between their supporting units, one below and one on top of strands 75, laterally offset from each other.

The two wires and interposed layer of strands now are ready for intertwisting. The performance of this operation presents a problem, since the assembly must be removed from contact with the bearing pads and forming trough in order to twist the wires together. However, the twisting necessarily occurs first at the end adjacent the motor so that if the entire assembly is removed from the pads and trough the strands will become disarranged and even freed completely from interengagement with the wires.

Hence, it is necessary to separate the trough and twisting assembly progressively as the twisting proceeds and the strands are secured to the wires. At the same time, wire gripping unit 84, the wires themselves, and drive shaft 134 must be maintained in substantial alignment.

This difficult result is achieved by further functioning of the shifting means which supports the forming trough.

As twisting motor 126 is started, crank lever 152 contemporaneously is raised by the operator, lowering the right hand end of trough 76 through the action of crank arm 156. This end of the trough thus is brought out of range of the twisting wires and strands.

The same action which lowers the right hand end of the trough does not immediately lower the left hand end thereof, however, because, as crank arm 178 on the left hand side of the assembly, actuated by thrust bar 172, is moved clockwise as viewed in the drawings, contact element 180 on the end of the arm moves freely in slot 184 of link 182 until it hits stop bolt 188. In the meantime, the left end of the trough is maintained in its elevated position by the force of weight 190 exerted on the underside of the trough through pivoted lever 192 and roller 198 which tracks on the underside of the trough.

As the sections of wire on the left hand end of the unit become involved in the twisting operation, crank lever 152 is raised further by the operator until contact element 180 abuts stop bolt 188, whereupon the left hand end of the trough gradually is depressed, against the force of weight 190. As the trough is depressed to the position of FIG. 11, post 190 which supports grip unit 84 remains stationary, since the crank mechanism is connected to sleeve 98 which slips freely over the post. As this occurs, the post is supported by abutment with bolt 104 threaded into the frame of the unit.

As the twisting proceeds, wires 80*a* and 80*b* become shortened correspondingly, drawing motor 126 forwardly on its carriage, and raising weight 142. The degree of advancement of the motor gives a measure of the degree of twisting of the wires and accordingly is used to determine the optimum degree of twisting, i.e. the amount sufficient to engage the strands securely without weakening the wires.

Accordingly limit switch 135 is placed along the track traversed by the motor carriage. This switch is in an electric circuit with the motor and, when contacted by the carriage, shuts the motor off, thus terminating the twisting operation.

The operator then releases handle 152 whereupon the trough shifting unit automatically returns, through the operation of weights 190 and 204 to its initial position of FIG. 7. The twisted wires then are cut free from shaft extension 112 and released from grip units 84, thus releasing the finished garland from the apparatus.

It has been found, surprisingly, that the direction of twisting exerts a profound effect upon the degree of suc-

cess achieved in trapping the strands in orderly arrangement between the wires. This effect is believed to be attributable to the fact that when fiberglass roving, consisting of a large number of tiny filaments, is cut into strands, each strand comprises a bundle of the tiny filaments of which the component filaments are interlocked by mutual overlapping and by cohesive forces so that the bundle can be made to behave as a single unit.

Since the bundles are overlapped by the spiral winding which generates them, the shingled effect of FIGS. 13 and 14 is achieved. It will become evident from a consideration of these figures that if the direction of twisting is in the direction of arrow 208, i.e. in a counterclockwise direction, the action of the bottom wire, working against the laterally offset top wire, will be to separate and disperse the component filaments of each bundle.

However, if the direction of twisting is clockwise, i.e. in the direction of arrow 210, the reverse effect is obtained; advantage is taken of the overlapped relation of the bundles; and the bundles accordingly hang together as a single unit which can be twisted uniformly into a final garland product having the appearance illustrated in FIG. 12.

This effect may be illustrated dramatically by grasping the two wires just in front of the assembly of overlapped strands and twisting the wires slowly, manually, first in one direction and then in the other. When the direction of twisting is counterclockwise, the bundles are broken up and only those strands at the leading end of the strand grouping are engaged and lifted up. However, when the direction of twisting is clockwise, the strands are lifted in a spiralled plane along almost the entire length of the wires.

It is to be understood that the form of our invention herein shown and described is to be taken as a preferred example of the same and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of our invention or the scope of the subjoined claims.

Having thus described our invention, we claim:

1. Garland forming apparatus comprising:

(*a*) a mandrel adapted to be wound spirally with filaments of material and, when wound, to be traversed longitudinally with cutting means for cutting the filaments, forming a multiplicity of strands of the material lying side by side, transversely of the mandrel;

(*b*) bearing means comprising a pair of spaced bearing strips positioned adjacent the mandrel, parallel thereto;

(*c*) grip means at one end of the bearing means for gripping the ends of a pair of stiffly flexible members extending the length of the bearing means, one on each side of the strands;

(*d*) twisting means at the other end of the bearing means for engaging the other ends of the stiffly flexible members and intertwisting the same;

(*e*) bearing means mounting means;

(*f*) and shifting means connected to the mounting means and operative to shift the same between a loading position wherein the bearing means is maintained spaced from the mandrel for receiving the stiffly flexible members, a filament-cutting position wherein the bearing means bears against the filaments securing them against displacement as they are cut into strands, and a twisting position wherein the bearing means is removed from the strands to permit intertwisting the stiffly flexible members without substantial disarrangement of the strands.

2. The garland forming apparatus of claim 1 wherein the mandrel comprises a rod having a circumference equal to the length of the strands and provided with a longitudinal slot dimensioned for receiving and guiding a knife used to cut the filaments into strands.

3. The garland forming apparatus of claim 1 wherein the bearing means comprises a pair of spaced resilient pads and a trough mounting the pads in its bottom, the width of the trough being substantially equal to the length of the strands.

4. The garland forming apparatus of claim 1 wherein the grip means comprise lever-operated wedges adapted to grip the ends of the stiffly flexible members.

5. The garland forming apparatus of claim 1 wherein the stiffly flexible members are wires.

6. The garland forming apparatus of claim 1 wherein the twisting means comprises a rotary shaft substantially aligned with the stiffly flexible members and provided at its end with engaging means for engaging the ends of the same.

7. The garland forming apparatus of claim 1 wherein the twisting means comprise a rotary shaft substantially aligned with the stiffly flexible members and provided at its end with apertures for engaging the ends of the stiffly flexible members.

8. The garland forming apparatus of claim 1 wherein the stiffly flexible members comprise a wire, the grip means comprises a spool about which the wire is adapted to be reversely bent at its midsection, and the twisting means comprises a rotary shaft having at its end hook-end-pin means about which the ends of the wire are adapted to be secured.

9. The garland forming apparatus of claim 1 wherein the twisting means comprises a rotary shaft in substantial alignment with the stiffly flexible members, engaging means on the end of the shaft for engaging the ends of the stiffly flexible members, a motor connected to the shaft, and pivotal mounting means for the motor and shaft for maintaining the engaging means on the shaft adjacent the bearing means as the bearing means is shifted from one of its operative positions to another.

10. The garland forming apparatus of claim 1 wherein the shifting means comprises jack means for moving the mounting means toward and away from the mandrel.

11. The garland forming apparatus of claim 1 wherein the shifting means comprises jack means and jack control means operative to move the mounting means sequentially toward and away from the mandrel, the end of the mounting means adjacent the twisting means being moved first away from the mandrel, the end of the mounting means remote from the twisting means remaining in strand-securing position pending progression of the intertwisting sequence until all of the strands have been secured.

12. The garland forming apparatus of claim 1 wherein the grip means is mounted on the bearing means, the grip mounting means including a shaft and telescoping sleeve, permitting maintenance of the grip means in operative relation to the bearing means as the bearing means is shifted between its various positions.

13. The garland forming apparatus of claim 1 wherein the shifting means comprises jack means positioned for shifting the mounting means toward and away from the mandrel, and wherein the twisting means is pivotally mounted and includes link means interconnecting the mounting means for the bearing means and the twisting means, the link means being operative to pivot the twisting means as required to maintain the same in operative relation to the bearing means.

14. The garland forming apparatus of claim 1 wherein the shifting means comprises a pair of crank shafts spaced from the mounting means one at each end thereof, crank means connected at one end to each of the crank shafts and at the other end to the mounting means, a crank lever connected to one of the crank shafts, and thrust and sway bar means operatively interconnecting the two crank shafts and the mounting means for transmitting the force applied to the crank lever substantially uniformly to both crank shafts.

15. The apparatus of claim 14 wherein the crank means connected to each crank shaft comprise a pair of lever

arms pivotally interconnected and arranged at an angle to each other, the lever arms connected to one of the crank shafts being interconnected through a pin and slot joint arranged to permit sequential shifting of position of the two ends of the mounting means, one end before the other.

16. The method of forming garlands which comprises placing clusters of strands transversely along the length of a horizontal stiffly flexible member, the clusters being arranged substantially parallel to each other with their adjacent side margins overlapped in shingled relationship, superimposing a second stiffly flexible member substantially parallel to the first but on the opposite side of the strands, and intertwisting the stiffly flexible members starting at one end thereof, the twisting being in the angular direction of cooperative support of the clusters by their overlapped margins, thereby locking the strands between the intertwisted stiffly flexible members.

17. The method of forming garlands which comprises placing clusters of fiberglass strands transversely along the length of a horizontal stiffly flexible wire, the clusters being arranged substantially parallel to each other in slightly biased relation to the wire with their adjacent side margins overlapping in shingled relationship; superimposing a second stiffly flexible wire substantially parallel to the first but on the opposite side of the strands and horizontally offset therefrom; and, starting at one end of the wires, intertwisting the same, the twisting being in the angular direction of cooperative support of the clusters by their overlapped margins, thereby locking the strands between the intertwisted wires.



**References Cited** in the file of this patent

UNITED STATES PATENTS

| | | |
|---|---|---|
| 220,918 | Grodzensky | Oct. 28, 1879 |
| 2,072,560 | Kranz et al. | Mar. 2, 1937 |
| 2,248,572 | Kelman | July 8, 1941 |
| 2,339,747 | Pettorossi | Jan. 18, 1944 |
| 2,414,378 | Kelman | Jan. 14, 1947 |