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APPARATUS FOR AND METHOD OF WINDING COILS ON SPOOLS

Original Filed April 9, 1951

2 Sheets-Sheet 1

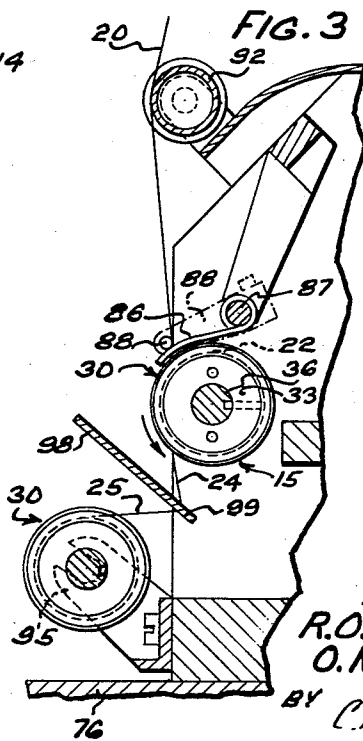
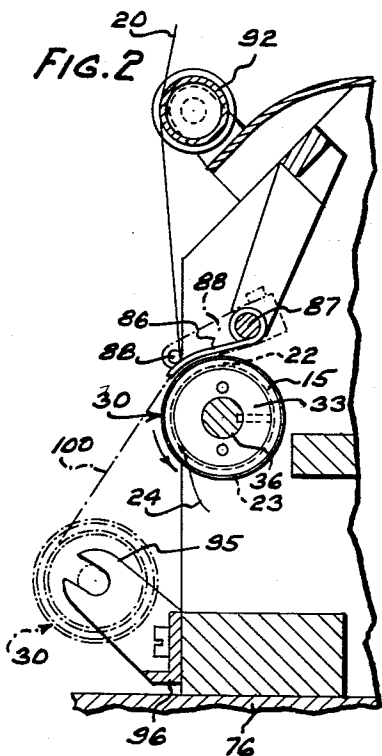
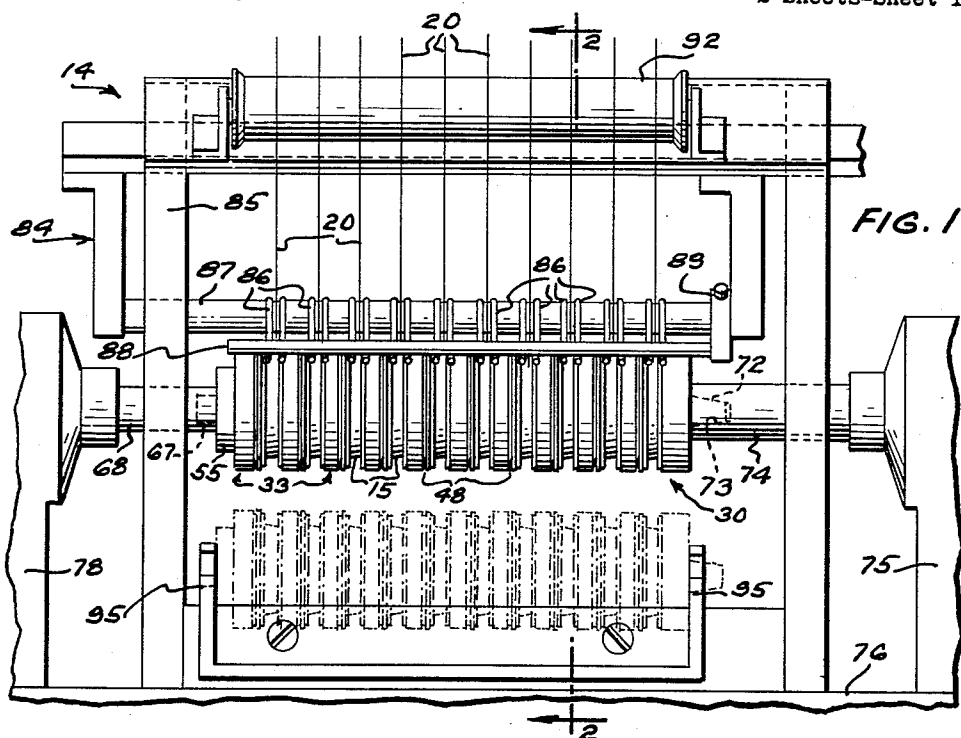


FIG. 10



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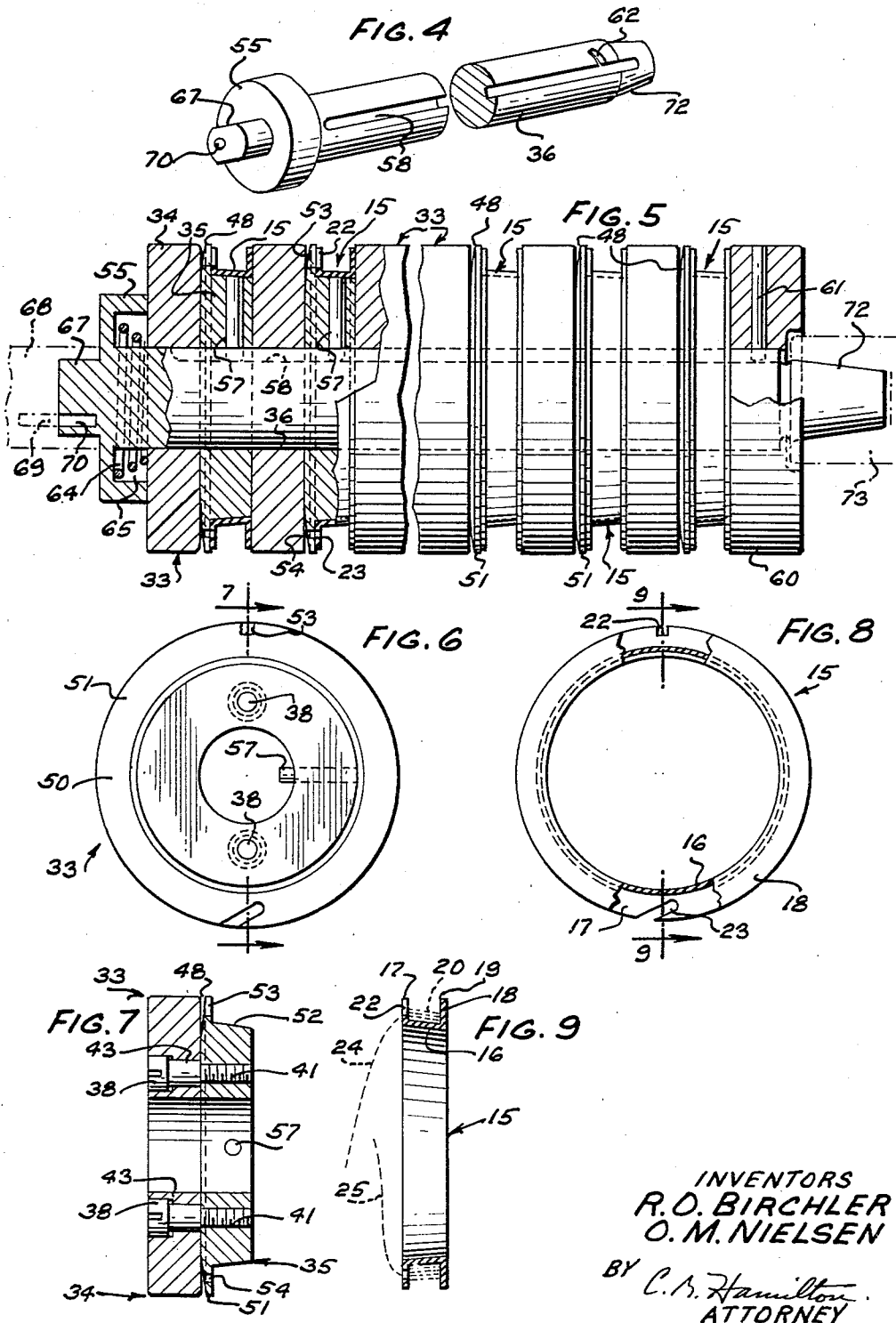
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APPARATUS FOR AND METHOD OF WINDING COILS ON SPOOLS

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Original application Apr. 9, 1951, Ser. No. 219,948, now Patent No. 2,815,905, dated Dec. 10, 1957. Divided and this application Apr. 22, 1957, Ser. No. 654,148

5 Claims. (Cl. 242—9)

This invention relates to an apparatus for and a method of winding coils on headed spools and is a division of co-pending application, Serial No. 219,948, now Patent No. 2,815,905, filed April 9, 1951, entitled Apparatus for Winding Cores on Spools.

In winding a plurality of coils on cylindrical cores, such as sheets of dielectric, which may also be interleaved between successive layers of the windings, various ways have been devised for holding the strands of wire during the beginning and the end of the winding operations so as to expedite the winding of the coils. However, in the winding of coils on cores or spools having heads or flanges on the ends thereof, difficulty has been experienced in simultaneously and expeditiously winding a plurality of such coils because of the problem of securing the ends of the strands of wire on the arbor and winding the initial convolution of strand onto the spools.

It is an object of the present invention to provide an improved apparatus for and method of simultaneously winding strands onto a plurality of spools.

In accordance with one embodiment of the invention a composite arbor is provided for supporting a plurality of spools thereon and having wire gripping grooves therein for holding the end portion of the wires to be wound on the spools. The arbor with the empty spools thereon is applied to the spindle of a winding machine and the end portion of the wires are moved laterally into the wire gripping grooves in the arbor after which the arbor is rotated and the wires are guided through notches in one of the heads of each spool onto the spools and wound thereon and when the coils have been wound the composite arbor is removed from the spindle of the winding machine and given a lateral twisting movement to carry the wires into slots formed in the heads of the spools to prevent the unwinding of the coils. The arbor with the wound coils thereon is then supported in a holder on the machine in laterally spaced and parallel relation to the spindle and another arbor with empty spools thereon is applied to the winding spindle after which a comb-like member is moved to engage the wires at a point on each wire between the two arbors and to force the wires into gripping engagement with the grooves on the empty arbor and the member is then moved further to sever the wires at these points between the arbors.

Other objects and advantages of the invention will become apparent by reference to the following detailed description thereof and the accompanying drawings illustrating a preferred embodiment of the invention, in which

Fig. 1 is a fragmentary front elevational view of a winding machine embodying the present invention;

Fig. 2 is a vertical sectional view of a portion of the machine taken on the line 2—2 of Fig. 1 showing an arbor in full lines in operative position on the winding spindle and showing in dotted lines an arbor on which the spools have been completely wound supported in a holder in spaced relation to the winding spindle;

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Fig. 3 is a view similar to Fig. 2 showing an arbor having a set of completely wound coils thereon in the holder and an arbor with a set of unwound spools thereon in operative position on the spindle and showing the 5 strands being moved by a comb into gripping engagement with the arbor;

Fig. 4 is a perspective view of the arbor shaft with portions broken away;

Fig. 5 is an enlarged longitudinal elevational sectional view of the composite arbor in assembled relation and showing the spools supported thereby;

Fig. 6 is a side elevational view of one of the annular spacers and spool supporting members of the composite arbor;

Fig. 7 is a cross-sectional view of the annular spool supporting member taken on the line 7—7 of Fig. 6;

Figs. 8 and 9 are side elevational and sectional views, respectively, of the spool on which a coil is to be wound; and

Fig. 10 is a fragmentary view of the comb member. The present coil winding machine 14 is designed to wind strands of wire on cores or spools 15, Figs. 8 and 9, each of which comprises an annular conical web or wall 16 and a pair of spaced flanges or heads 17 and 18 extending laterally outwardly therefrom to form with the wall 16 an annular channel 19 in which the strand 20 is wound to form the coil. The head 17 is provided with a notch or recess 22 through which the strand passes during the initial portion of the winding operation. On completion of the winding of the coil, the strand is hooked or passed into an angular slot 23 also formed in the head 17 to retain the strand and prevent the unwinding of the coil. The ends 24 and 25 of the strand extending through the slots 22 and 23 respectively form leads for the coil wound on the spool.

A plurality of the spools 15 are adapted to be mounted in coaxial and spaced relation to each other on a composite arbor 30, Figs. 1 and 5, comprising an arbor shaft or shank 36 and a plurality of annular spool supporting and spacing elements 33, Figs. 6 and 7. Each of the elements 33 comprises a pair of rings 34 and 35, Fig. 7, having cylindrical apertures for receiving the cylindrical shank 36 and secured together by a pair of shouldered machine screws 38, Fig. 7, secured in threaded apertures 41 in the ring 35 and extending outwardly therefrom through apertures 43 in the ring 34 for supporting the ring 34 for limited axial movement relative to the ring 35. One of the meeting faces of the rings 34 and 35 is beveled slightly to form a narrow annular V-shaped groove 48 for receiving the strand 20 of wire therein for grippingly engaging the wire. The ring 35 is provided with an annular rabbet 50 forming a relatively thin flange 51 engageable with the head 17 on the spool 15 and a conical surface 52 engageable with the web 16 of the spool for supporting the spool 15 in position thereon. The flange 51 of the ring 35 is provided with notches 53 and 54 which are substantially of the same size as the notches 22 and 23 in the spool 15 and with which the notches 22 and 23 are alignable when the spool is assembled on the element 33.

A plurality of the annular spacing elements 33 are assembled on the shank 36 of the arbor as shown in Fig. 5 with the ring 34 of the first element abutting a head or shoulder 55 on one end of the arbor shank 36. Pins 57 on the rings 35 extending radially inwardly into the aperture thereof engage in a keyway 58 in the arbor shank 36 to position the annular elements 33 and the spools 15 previously assembled thereon with the notches 53, 22 and 54, 23, respectively, in axial alignment, and a locking collar 60 having a pin 61 engageable in a bayonet slot 62 in the shank of the arbor serves to lock the annular elements 33 and the spools 15 in assembled rela-

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tion on the shank 36. The spools 15 are made from slightly resilient thermoplastic material and have axial dimensions slightly greater than the axial distance of the shoulder 52 of the ring 35 so that when the spools 15 are positioned in the grooves 50 in the annular members 33, they extend slightly beyond the outer surface of the ring 35, and when the annular elements 33 and the spools 15 are assembled on the arbor, the spools 15 are slightly compressed when the locking ring 60 is applied to the arbor to lock the components on the arbor. The resiliency of the spools 15 thus serves to maintain the parts in firm and tight engagement with each other.

When spools made from non-compressible material are used, the elements 33 and spools thereon are held in compressed relation by an expansion spring 64 surrounding the arbor shank and disposed within the recess 65 formed in the head 55 of the arbor.

One end 67 of the arbor, which projects beyond the head 55, is flattened to provide a non-circular part which is receivable in a conforming socket in the end of the head stock spindle 68 of the winding machine 14. A pin 69 in the head stock mounted eccentric to the axis of the spindle is receivable in a recess 70 in the end 67 of the arbor to insure the insertion of the arbor end 67 within the socket in only one position. The opposite end 72 of the arbor is tapered and is receivable in a tapered socket 73 in the tail stock spindle 74.

The tail stock spindle 74 is rotatable in a support 75 mounted on a base 76 of the winding machine and is movable axially into and out of engagement with the arbor and is adapted to be locked in engagement with the arbor by conventional locking means not shown. The head stock spindle 68 is likewise mounted for rotation in a support 78 mounted on the base 76 and is adapted to be rotated under control of the operator by a suitable drive means (not shown). A distributor 84 mounted for reciprocation in a frame 85 is provided for distributing the wires 20 in the spools 15 during the coil winding operation and comprises pairs of guide fingers 86 fixed to a rod 87 of the distributor 84 for reciprocation therewith. The wires 20 pass between the fingers 86 and under a rod 88 which is supported by an arm 89 on the bar 87 of the distributor and extends parallel to the arbor. Mechanism (not shown) is provided for reciprocating the distributor 84 in timed relation to the rotation of the head stock spindle 68 in a manner well known in the coil winding machine art. The wires 20 are withdrawn from supply reels (not shown) mounted above the winding machine and are guided over a guide roller 92 and into engagement with the distributing fingers 86 and guide rod 88 of the distributor as they are wound onto the spools 15. Slotted arms 95 of a U-shaped bracket 96 fixed to the base 76 form a holder for receiving the ends of a composite arbor having fully wound coils thereon to support the arbor and coils in spaced and fixed relation to the winding spindle 68 prior to the severing of the strands of the wire from the coils.

In the operation of winding the coils, the spools 15 are assembled on the elements 33 with the notches 22 and 23 of the spools 15 in alignment with the corresponding notches 53 and 54 in the elements 33. The elements 33 with the spools thereon are then assembled on the arbor shank 36 and locked in position by the collar 61. An assembled arbor with the empty spools thereon is then applied to the spindle 68 and locked in position with the tail stock spindle 73 after which the free ends 24 of the wires 20 are moved in a direction transversely to the length thereof into the clamping grooves 48 of the spool supporting elements 33 to secure the ends of the wire to the arbor. At the beginning of the winding operation the winding spindle 68 is in a predetermined angular position to receive and position the arbor and the elements 33 and the spools 15 thereon in a predetermined angular position with the notches 22 and 53 in the spools 15 and the elements 33, respectively, posi-

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tioned as shown in Figs. 2 and 6. In this position the notches 22 and 53 are spaced a relatively small angular distance from and to the rear of the wires 20 as seen in Fig. 2, and the wires 20 as viewed in Fig. 1 with their ends 24 gripped in the grooves 48 are urged to the right by the distributor fingers 86 so that upon rotation of the arbor the wires 20 will ride on the periphery of the flange 51 and fall into the notches 53 and 22 of the flange 51 and the head 17 of the elements 33 and the spools 15, respectively, and enter the channel 19 of the spool and be wound on the spool as the arbor is rotated.

After predetermined lengths of the wires have been wound on the spools the winding spindle 68 is stopped in the same predetermined angular position shown in Fig. 2 after which the tail stock spindle 73 is retracted and the arbor with the wound coils thereon is removed from the spindle 68 by the operator who then turns the arbor to position the slots 23 and 54 of the spools 15 and flanges 51, respectively into close proximity and alignment with the wires 20 and imparts a lateral movement or twist to the arbor to cause the wires 20 to enter the slots 23 and 54 to prevent the uncoiling of the wires from the spools. The arbor with the wound coils thereon is then deposited in the slotted arms 95 and is supported thereby in fixed and spaced relation to the axis of the winding spindle 68. A portion of the wires 20 extend from the wound spools on the arbor to the rod 88 and the distributor fingers 86 as shown in Fig. 2. Another composite arbor with empty spools thereon is inserted in operative position in the machine in driving engagement with the winding spindle 68 and supported by the tail stock spindle 73.

A comb member 98 having a serrated edge 99 forming V-shaped grooves spaced apart distances equal to the spacing of the wires 20 and spools 15 is provided to move the wires 20 into engagement with the clamping grooves 48 in the arbor on the winding spindle and to sever the portions of the wire extending between the two arbors. This is done by engaging the serrated edge 99 of the comb 98 with the inclined portion 100 of the wires 20, Fig. 2, and moving the comb forwardly and downwardly to the position shown in Fig. 3 which will cause portions of the wire to engage and to be gripped in the grooves 48 of the arbor on the winding spindle after which continued movement of the comb 98 will cause the wires 20 to be severed where they engage the comb. The ends 24 and 25 of the wire 20 formed by the severance of the wire form the leads of the coils as previously stated. The arbor with the fully wound coils thereon may be removed from the holder 95 after which the locking collar is removed from the arbor to permit the elements 33 and the spools 15 with the coils thereon to be slid off of the arbor shank and separated from each other.

It is to be understood that the above-described arrangements are simply illustrative of the application of the principles of this invention. Numerous other arrangements may be readily devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

1. In a machine for winding coils on spools the combination of a plurality of arbors for supporting a plurality of spools, annular members on the arbors for spacing the spools and having annular wire-gripping grooves with diverging strand-engaging surfaces adjacent the ends of said spools for holding the ends of the wires to be wound onto the spools, means for securing the annular members and the spools on the arbors against rotation to form composite arbors, means for supporting a first composite arbor in a winding position, means for rotating the composite arbor, and means for supporting a second composite arbor against rotation in parallel, adjacent, and laterally spaced relation to said first composite arbor

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in said winding position so that the wires extending from coils wound on the spools of said second composite arbor and connected to supplies thereof are substantially aligned with the wire-gripping grooves of the annular members on said first composite arbor.

2. In a coil winding machine, a rotatable spindle, a plurality of arbors connectible individually to said spindle for supporting a plurality of individual spools for rotation therewith, annular members for spacing the spools on the arbor and having annular wire-gripping grooves with diverging wire-engaging surfaces for gripping and holding the ends of the wires to be wound onto the spools, means for releasably securing the annular members and the spools on the arbors to form composite arbors, means for supporting a first composite arbor in a winding position in engagement with said spindle, mounting means for supporting a second composite arbor in a predetermined position in parallel and spaced relation to said first composite arbor so that the wires extending from coils wound on the spools of said second composite arbor and connected to supplies thereof are substantially aligned with the wire-gripping grooves of the spacing members on the first composite arbor, and means on said mounting means for holding the second composite arbor against rotation.

3. A method of winding a coil on a spool which comprises securing a spool and an annular strand-gripping member on each of a plurality of arbors to form composite arbors, supporting a first composite arbor on a winding spindle, engaging an end portion of a strand extending from a supply thereof and moving it laterally into the strand-gripping member to secure the end to the composite arbor, rotating the composite arbor to wind a predetermined length of strand onto the spool, removing the composite arbor from the winding spindle and supporting it against rotation in a predetermined position in spaced and parallel relation to its winding position on the spindle and to one side thereof, supporting a second composite arbor on the winding spindle, and engaging the strand at a point thereon between the composite arbors and moving the point in a direction between the composite arbors to force the strand into the wire-gripping member on the second composite arbor to secure the strand thereto and to sever the strand at said point between the composite arbors.

4. A method of winding coils on spools which comprises assembling a plurality of spools and annular strand-gripping members on each of a plurality of arbors to

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form composite arbors, supporting a first composite arbor in a winding position, engaging the end portions of strand extending from supplies thereof and moving them laterally into the strand-gripping members to secure said end portions to said first composite arbor, rotating said composite arbor to wind predetermined lengths of strand onto the spools, removing the composite arbor from the winding position and supporting it against rotation in a predetermined position in spaced and parallel relation to its winding position and to one side thereof, supporting a second composite arbor in said winding position, engaging portions of the strands between the composite arbors and moving them in a direction between the composite arbors to force the strand into the wire-gripping member on the second composite arbor to secure the strand thereto, and severing the strands between the composite arbors.

5. A method of winding strands on spools which comprises assembling a plurality of spools and annular strand-gripping members on each of a plurality of arbors to form composite arbors, supporting a first composite arbor in a winding position, engaging end portions of strands extending from supplies thereof and moving them laterally into the strand-gripping members to secure the ends to said first composite arbor, rotating the composite arbor to wind predetermined lengths of strand onto the spools, removing the composite arbor from the winding position and supporting it against rotation in a position in spaced and parallel relation to its winding position and on one side thereof, supporting a second composite arbor in said winding position, and engaging points of the strands between the composite arbors and with one movement advancing the points in a direction between the composite arbors to force the strands into the wire-gripping members on the second composite arbor to secure the strands thereto and to sever the strands at said points.

References Cited in the file of this patent

UNITED STATES PATENTS

862,935	Pfanstiehl	Aug. 13, 1907
1,814,389	Jacobsen	July 14, 1931
2,200,000	Johnstone	May 7, 1940
2,214,384	Roby et al.	Sept. 10, 1940
2,432,270	Asbill	Dec. 9, 1947
2,537,457	Gref	Jan. 9, 1951
2,666,168	Lorant	Jan. 12, 1954