Oct. 12, 1943. G. E. BERGGREN ET AL 2,331,648

STAND TWISTING APPARATUS

Filed July 23, 1942 4 Sheets-Sheet 1

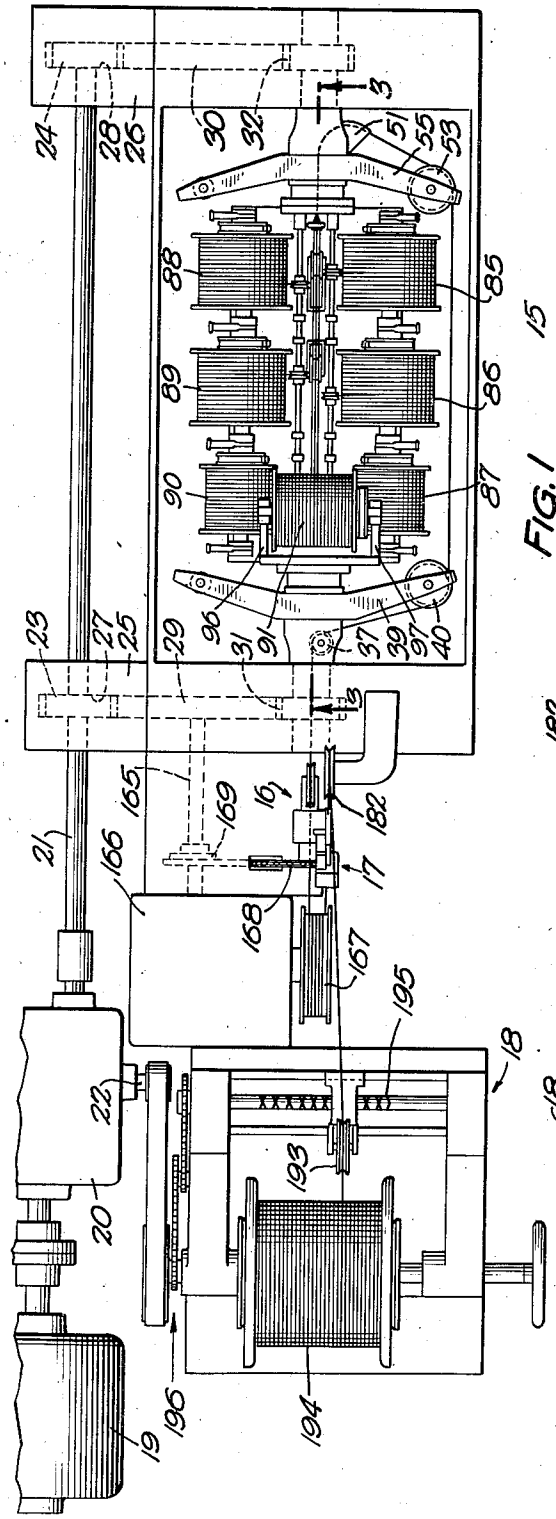


FIG. 1

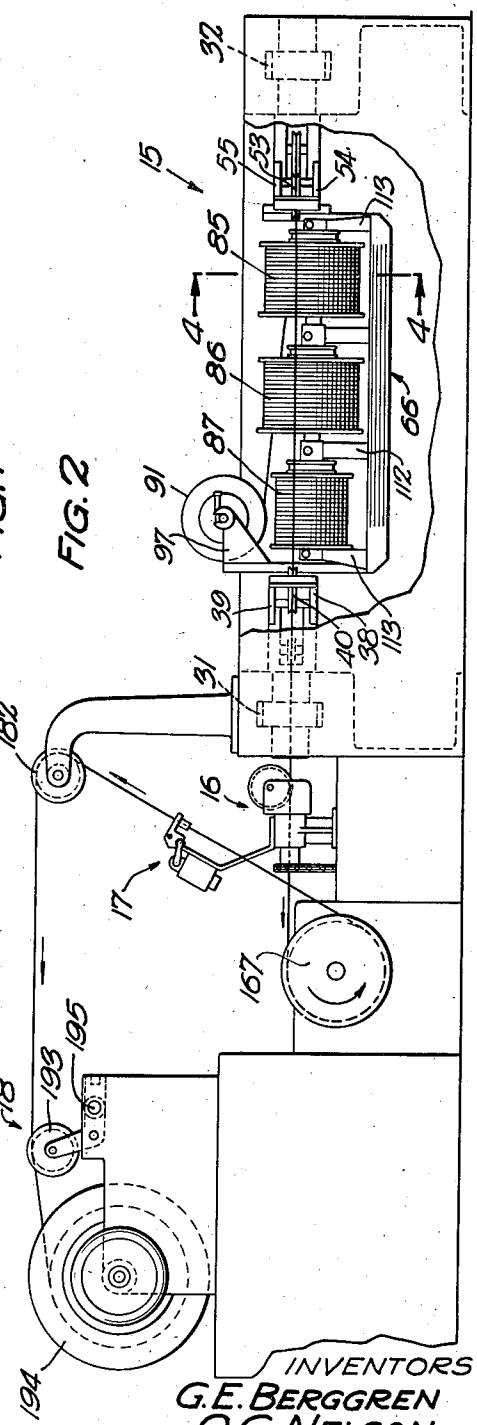


FIG. 2

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STAND TWISTING APPARATUS

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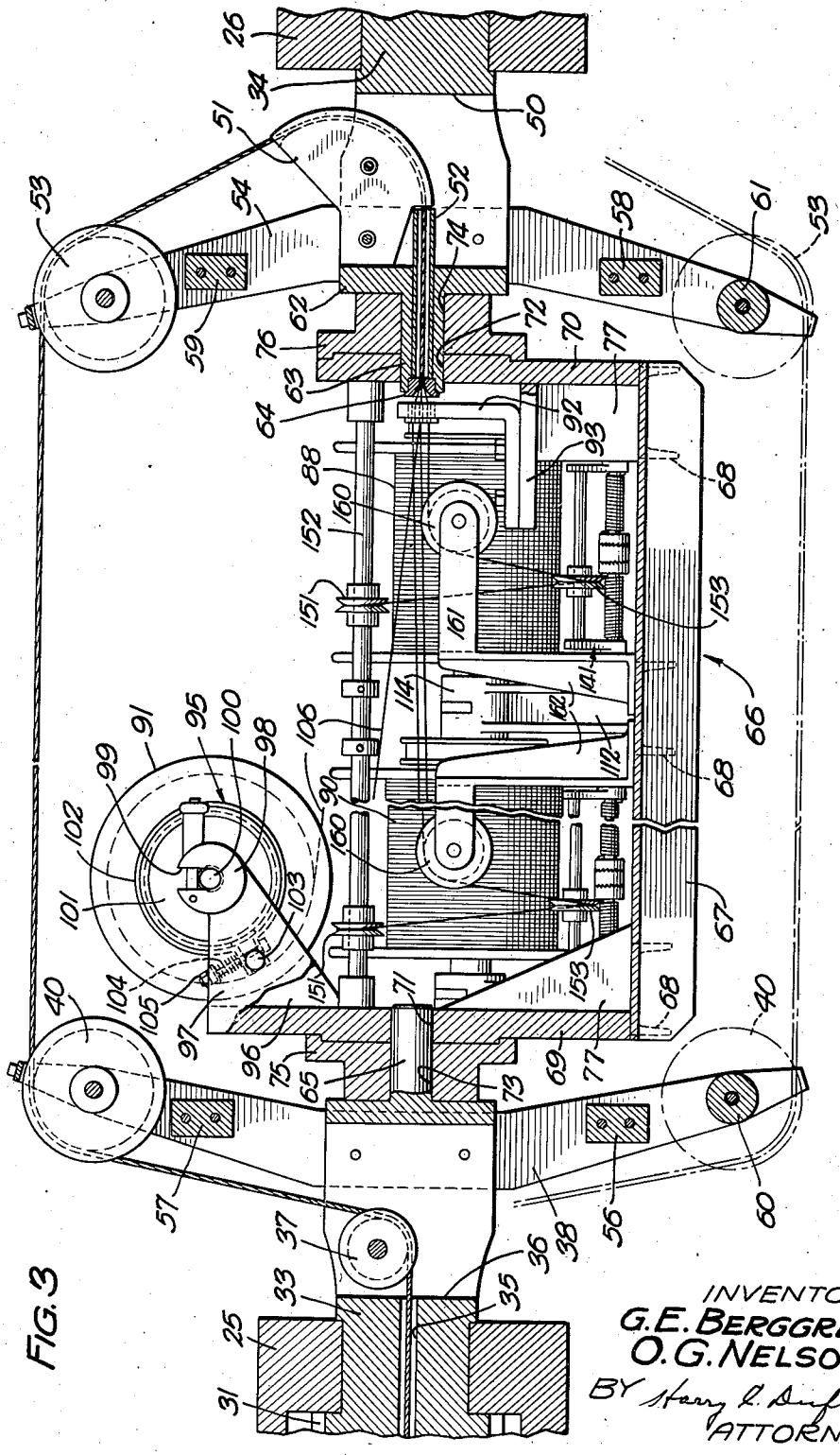


FIG. 3

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STAND TWISTING APPARATUS

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FIG. 4

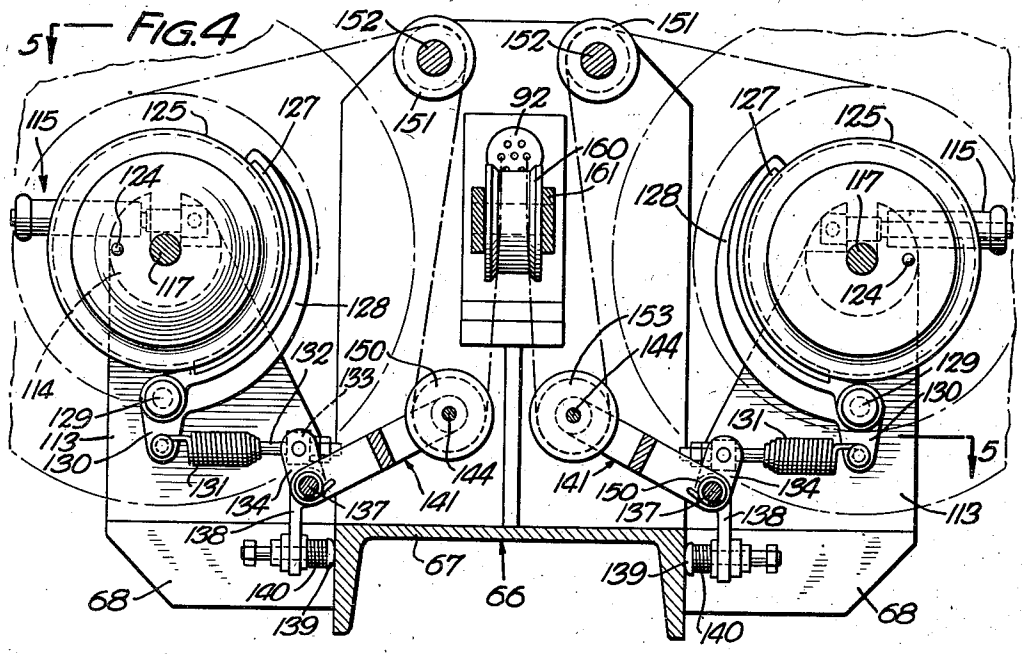
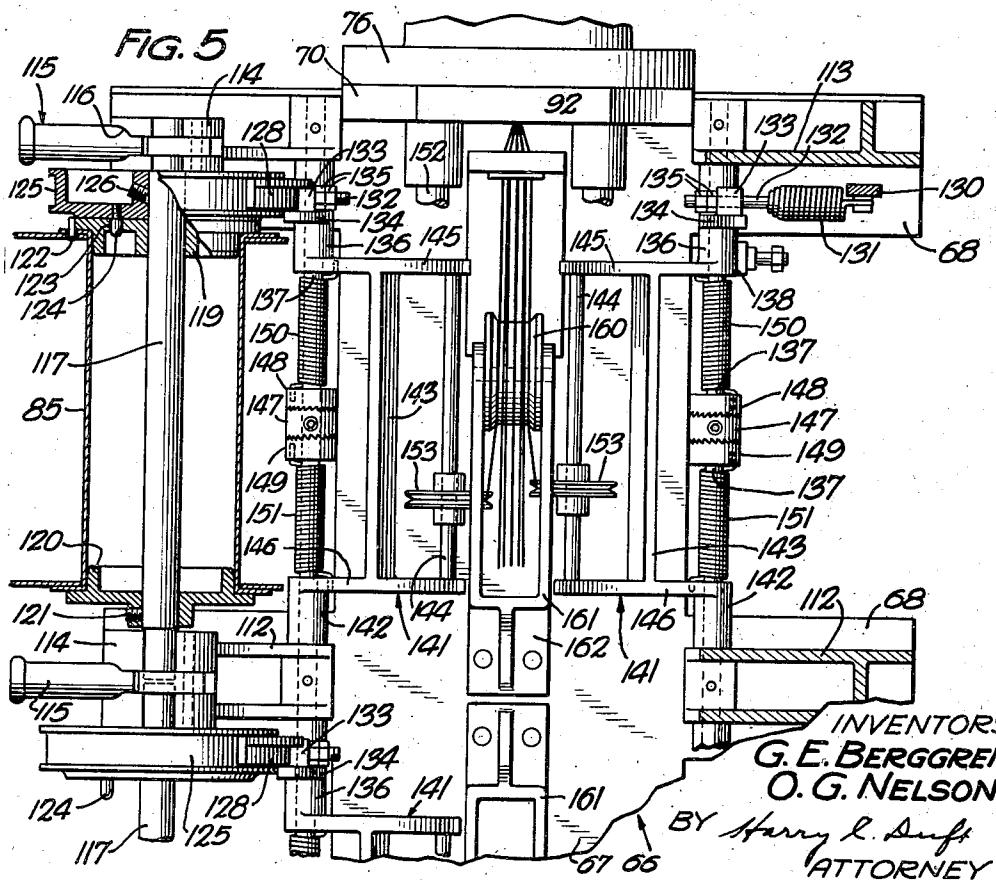


FIG. 5



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STAND TWISTING APPARATUS

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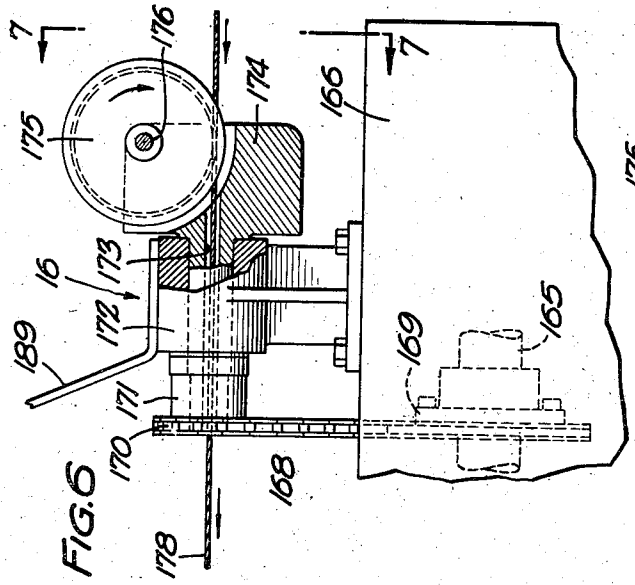


FIG. 6

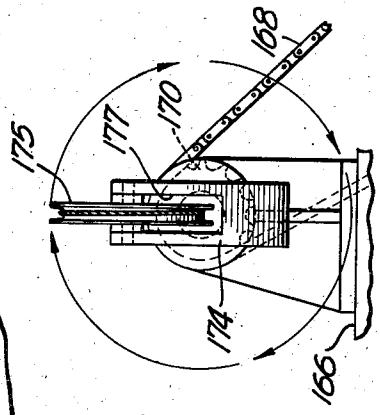


FIG. 7

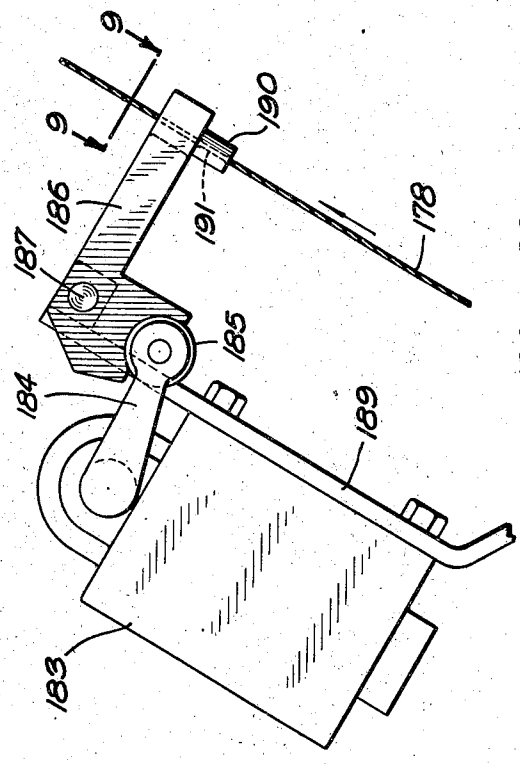


FIG. 8

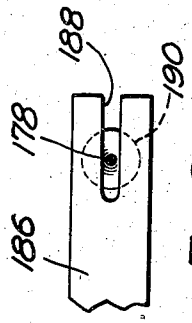


FIG. 9

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UNITED STATES PATENT OFFICE

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STRAND TWISTING APPARATUS

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Application July 23, 1942, Serial No. 452,026

5 Claims. (Cl. 57—58)

This invention relates to strand twisting apparatus and more particularly to apparatus for twisting relatively resilient and non-resilient strands into a cable.

It is an object of the present invention to provide a simple and efficient apparatus for twisting strands into a cable.

In accordance with one embodiment of the invention as applied to an apparatus for twisting a combination of steel and copper wires into a cable, an apparatus has been provided wherein a plurality of wires are carried around a plurality of supply spools by means of a flyer which twists them into a strand, means being provided for maintaining a predetermined tension on the wire drawn from the supply spools. The supply spools rest in a cradle which maintains itself in position by its own weight, being suspended on trunnions, through one of which the strands of wire pass to the flyer. Outside the cradle and removed from the path of the flyer, there is provided a sheave freely rotatable about its own axis and driven to rotate around the axis of the cable as the cable is taken up and distributed on a takeup reel, a pass of the cable being wrapped around the sheave. This sheave is driven in a direction opposite to the direction of rotation of the flyer whereby the strand of cable is twisted tighter than the required lay between the flyer and sheave and untwisted an amount equal to the excess twist between the sheave and a capstan which draws the strands forming the cable from the supply spools.

In this apparatus, there is provided a gaging die, through which the stranded cable passes after it has been twisted the desired amount. This die normally rides on a cable encircling it and when the cable is kinked or has a large undesirable lump on it, the gaging die will move with the cable and actuate an electrical switch to interrupt the operation of the apparatus.

A better understanding of the invention may be had by reference to the accompanying drawings, wherein

Fig. 1 is a general plan view of apparatus embodying the invention, the housings of parts of the apparatus being removed to illustrate more clearly the general location of the parts;

Fig. 2 is a side elevational view of the apparatus shown in Fig. 1;

Fig. 3 is a longitudinal vertical sectional view on an enlarged scale, taken substantially along the line 3—3 of Fig. 1 in the direction of the arrows, parts being broken away to illustrate more clearly those parts positioned behind them and the flyer being rotated 90° from the position shown in Fig. 1;

Fig. 4 is a transverse vertical sectional view on substantially the same scale as Fig. 3, taken along the line 4—4 of Fig. 2 in the direction of the arrows and showing some of the means for applying tension to the strands as they are withdrawn from the supply spools;

Fig. 5 is an irregular plan sectional view taken substantially along the line 5—5 of Fig. 4 in the direction of the arrows and showing the method of supporting the supply spools in the cradle;

Fig. 6 is a fragmentary detailed view of the sheave for untwisting a section of the cable and applying additional twist to another section of the cable to give it the desired lay;

Fig. 7 is a sectional view taken substantially along the line 7—7 of Fig. 6 in the direction of the arrows;

Fig. 8 is an enlarged detail sectional view of a part of the control mechanism of the apparatus; and

Fig. 9 is a fragmentary sectional view taken substantially along the line 9—9 of Fig. 8 in the direction of the arrows.

By reference to the drawings, it will be noted that as seen particularly in Figs. 1 and 2, the apparatus comprises three principal parts—a flyer unit 15, a post former unit 16, a gaging unit 17, and a takeup unit 18. All of the various units of the apparatus are driven by a motor 19, which drives a gear reducer 20, which may be of any suitable construction adapted to rotate a pair of shafts 21 and 22 at predetermined speeds and in timed relation one with another. The shaft 21 has fixed to it a pair of driving gears 23 and 24 and is journalled in bearing blocks 25 and 26 which are slotted at 27 and 28 to receive the gears 23 and 24. Also mounted in the bearing blocks 25 and 26 are intermediate gears 29 and 30, which mesh with the driving gears 23 and 24 and with gears 31 and 32 formed on flyer supporting studs 33 and 34, respectively (Fig. 3). The flyer supporting stud 33 has a central aperture 35 extending axially through it and is provided with a slot 36 in which a guide pulley 37 is freely rotatable. The flyer supporting stud 33 has opposed flyer arms 38 and 39 fixed to it between which arms there is journalled a guide sheave 40. This sheave 40 is adapted to receive the cable formed in the apparatus and guide it to the pulley 37.

The flyer supporting stud 34 is slotted as shown at 50 in a manner somewhat similar to that described in connection with the stud 33. Posi-

tioned in the slot shown at 50 is a guide member 51, which guides a cable, that has been passed through a tube 52 coaxial with the flyer supporting stud 34, to a sheave 53 mounted between flyer arms 54 and 55 fixed on opposite sides of the flyer supporting stud 34. The flyer arms 38 and 39 are spaced apart by blocks 56 and 57 and the flyer arms 54 and 55 are spaced apart by blocks 58 and 59. The ends of the flyer arms 54 and 55 and 38 and 39 away from the sheaves 53 and 54 are provided with weights 60 and 61 to counter-balance the sheaves 40 and 53 so that the portions of the flyer arms extending on opposite sides of the studs 33 and 34 will be balanced. The end of the flyer supporting stud 34, which extends toward the other flyer stud 33 is provided with an end portion 62 apertured to receive the tube 52 and having a tubular axial projection 63 thereon. The tubular axial projection 63 has set into it a stranding die 64, through which the wires which make up the cable pass to the guide member 51.

The projection 63 cooperates with a projection 65 on the flyer supporting stud 33 to form trunnions for supporting a cradle, designated generally by the numeral 66, in position between the flyer arms where the cradle will remain substantially stationary during the rotation of the flyer arms about the cradle. The cradle 66 includes a base framework made up of a longitudinally extending relatively heavy channel member 67, which has extending out from the sides of it and welded to each side of it four channel member supports 68—68. The main longitudinally extending channel member 67 has suitably fixed to it, for example, by welding, a pair of plates 69 and 70, which are provided with apertures 71 and 72 in alignment with similar apertures 73 and 74 formed in bearing members 75 and 76. The trunnion projections 63 and 65 enter the aligned apertures 73 and 71 and 72 and 74 and serve to support the crade 66. Gusset plates 77 serve to brace the cradle structure by engaging with the main longitudinally disposed channel member 67 and with the pair of plates 69 and 70.

In the cradle formed by this structure, there are mounted seven wire supply spools 85, 86, 87, 88, 89, 90 and 91, each of which is provided with a brake to be described more in detail hereinafter and from which wires may be directed to a lay plate 92, which is positioned to properly guide each individual strand of wire into the stranding die 64. The lay plate 92 is mounted upon a flat portion 93 formed on gusset plates 77. The spools 85 to 90 are each mounted in a similar manner on the cradle 66 and are provided with tension controlled brakes whereas the spool 91, which supplies the core or central strand of the cable, is provided with a drag brake 95 (Fig. 3). The spool 91 is mounted between brackets 96 and 97 (Figs. 1, 2 and 3) which extend inwardly of the cradle from end plate 69. Each of these brackets 96 and 97 is provided with a bearing portion 98 having a bearing notch 99 into which a shaft 100 may be set. The shaft 100 has a brake drum 101 suitably fixed to it and the spool 91 is suitably fixed to the brake drum 101. Encircling the brake drum 101 is a brake band 102 having one end attached to a pin 103 and the other end resiliently urged toward the pin 103 by a spring 104, the tension of which may be adjusted by a tension adjusting nut 105. A strand of wire 106 may be withdrawn from the spool 91 and fed directly through the lay plate 92 to the stranding die 64.

Extending upwardly from each of the channel members 68 is a bearing support 112 or 113, the four bearing supports 112 adjacent the middle of the cradle 66 being of identical construction and the four bearing supports 113 at the ends of the cradle being of identical construction. These bearing supports have bearings 114 (Figs. 3, 4 and 5) at their upper ends, which are similar to the bearings 98 on the brackets 96 and 97 and each of the bearings 114 and the bearing 98 are provided with quick acting snap locks 115 pivoted at one side of the bearing and having a spring cylinder resiliently urged into an aperture 116 (Fig. 5) in the bearing 114 to hold the spool supporting shafts or arbors in place. The arbors which support the spools 85, 86, 87, 88 and 89 are all of the same construction and, as illustrated in Fig. 5, the arbor designated 117 has a pair of spool supporting collars 119 and 120 mounted upon it. The spool supporting collar 120 is fixed to the arbor 117 by means of a set screw 121, whereas the collar 119 is provided with an inwardly extending pin 122 adapted to engage in an aperture in the flange of the spool 85. The collar 119 is provided with an aperture 123 into which extends a pin 124 fixed in a brake drum 125. The brake drum 125 is, in turn, attached to the arbor 117 by means of a set screw 126. This assembly, comprising the arbor, the spood supporting collars, the brake drum and the spool 85, may be dropped into the bearing notches in the bearings 114 and locked in place by means of the snap locks 115. It should be noted that the intermediate ones of the snap lock 115 extend over the ends of two arbors and lock them in place.

Cooperating with the brake drums 125 are brake blocks 127, as shown most clearly in Figs. 4 and 5. The brake blocks are formed to conform to the shape of the brake drum 125 and are mounted on brake arms 128. Each brake arm 128 is pivoted on a stud shaft 129 extending from the bearing support 112 or 113, most closely adjacent the brake drum 125. Extending downwardly from each brake arm 128 is a lever 130, which may be formed integrally with the brake arm and which is interconnected by means of a relatively heavy coil spring 131 with a threaded rod 132. The threaded rod 132 (Figs. 4 and 5) extends through a pivot block 133 pivotally mounted on the upper end of a lever arm 134 and the rod 132 may be locked on the pivot block 133 by lock nut assembly 135. The lever arm 134 is formed integrally with a sleeve 136 mounted on a pivot rod 137. The sleeve 136 also has formed integrally with it a downwardly extending arm 138 having an abutment 139 resiliently mounted in it, the abutment normally being urged away from the arm 138 by a spring 140. Thus, the sleeve 136 and parts carried by it will normally be urged in a direction to apply a definite braking pressure to the brake drum 125 through the action of the brake block 127. However, the sleeve 136 forms part of a sheave supporting framework 141 (Fig. 5) which comprises the sleeve 136, a complementary sleeve 142, an interconnecting cross member 143, and a sheave supporting rod 144. These parts may be suitably secured together or the sleeves 136, 142 and cross member 143 may form parts of a casting in which a rod 144 may be suitably mounted, end plates 145 and 146 extending from the sleeves 136 and 142 and being interconnected by the cross member 143.

The pivot rod 137 has fixed to it a toothed

clutch member 147 and has surrounding it a pair of clutch collars 148 and 149. The clutch collars 148 and 149 are interconnected with the sleeves 136 and 142 by coil springs 150 and 151, respectively, which encircle the pivot rod 137 and are under compression to oppose the action of the spring 140, thus tending to rock the sheave supporting framework downwardly (Fig. 4). It will be understood that there is a sheave supporting framework 141 associated with each of the supply spools 85 to 90 and that each of these sheave supporting frameworks are constructed in exactly the same manner as the one most clearly illustrated in Figs. 4 and 5. Furthermore, each of the supply spools is provided with a brake drum 125 arranged in the same manner as the spool 85.

The sheave supporting rod 144 has slidably and rotatably mounted upon it a guide sheave 153, which cooperates with an upper guide sheave 151 slidably and rotatably mounted on a rod 152 which extends between the plates 69 and 70, there being two of the rods 152 provided, one at each side of the cradle 66 for supporting the guide sheaves associated with the various wire supply spools on their respective sides of the cradle 66.

From the foregoing, it is believed to be apparent that by suitably adjusting the tension in the various springs, the tension under which the wires drawn from the supply spools 85 to 90 may be controlled and that the guide sheaves 153 and 151 will slide back and forth on their respective supporting rods to guide the wire as it is drawn from various supply spools. After the wire has been passed over the guide sheave 151 and around the guide sheave 153, it will be directed to an idler pulley member 160, three of which are provided in the apparatus, each guide member 160 serving to guide the two wires drawn from supply spools on opposite sides of it and to direct them to the lay plate 92. The guide members 160 are freely rotatable between the arms of U-shaped brackets 161 extending in a horizontal direction from upright support brackets 162, the upright support brackets 162 being mounted on the main channel member 67 of the cradle 66. As the wires are drawn from the various supply spools 85 to 91 and directed to the lay plate 92 and thence through the stranding die 64, they will have two twists imparted to them between the lay plate 92 and the guide pulley 37 for each rotation of the flyers about the cradle 66.

The wires fed from the supply spools 85, 86, 88, 89 and 91 are copper wires which are to be assembled with steel wires drawn from the supply spools 87 and 90 and due to the difference in resiliency of the copper and steel wires, and especially due to the resiliency of the steel wires, the cable would tend to become untwisted if it were simply fed onto a takeup reel after being twisted in the apparatus described hereinbefore, and, accordingly, in following the present invention, the cable composed of the strands withdrawn from the supply spools 85 to 91 are directed out through the aperture 35 in the flyer supporting stud 33 and are directed to the post former unit 16 before being directed to the takeup unit 18. If all of the wires on supply spools 85 to 91 are "dead" copper wires, the cable thus formed might be directed to any suitable takeup device, such as the takeup unit 18, to be described hereinafter, without untwisting the cable and the desired lay of the twisted strands could be set into the cable simply by using the flyer described hereinbefore. However, when relatively resilient wires are to be stranded in the cable, the post former unit 16 is used to apply an additional twist to the wires between it and the flyer and to untwist the cable a predetermined amount equal to the additional twist between it and the takeup unit 18. The amount of additional twist put into the cable and then taken out depends upon the resiliency of the wire.

In accordance with the preferred form of the invention, the gear 29 is mounted upon a shaft 165 which extends into and drives a gear reducer 166 for driving a capstan 167 at a definite rate of speed and in synchronism with the rotation of the flyer. In passing from the flyer unit to the capstan 167, the cable is twisted and then untwisted an equal amount by post former unit 16, which will now be described. As most clearly shown in Figs. 6 and 7, the post former unit 16 is driven from the shaft 165 by a chain 168 engaging a sprocket 169. The chain 168 engages and drives a sprocket 170 fixed to a rotatable member 171 suitably supported in a bearing 172, which is, in turn, mounted upon the housing of the gear reducer 166. The rotatable member 171 is provided with an axial passage 173 and is suitably held for rotation in the bearing 172. At the right end (Fig. 6) of the rotatable member 171, a slotted portion 174 is provided for supporting a post former sheave 175. The sheave 175 is freely rotatable about a shaft 176 and rotates in a slot 177 formed in the portion 174. From the foregoing, it is believed to be apparent that a cable 178 formed of wires drawn from the supply spools 85 to 91 will be directed from the flyer unit 15 to the post former unit 16, where it will be passed around the sheave 175. Rotation is imparted to the rotatable member 171, which will carry the sheave 175 bodily about the axis of the cable 178 as the cable 178 is drawn through the rotatable member 171 and as the cable 178 rotates the freely rotatable post former sheave 175. Thus, the cable of stranded wires is twisted by the flyer the exact amount desired in the finished cable and is twisted tighter than the required lay between the flyer unit 15 and the post former unit 16 by the operation of the post former unit 16. Since the cable cannot twist at its takeup end, the cable is untwisted by the post former unit 16 an amount equal to the difference between the required lay as applied by the flyer and the lay applied by the post former unit 16 to set the wires in the cable so that the finished strands of wire are "dead" and will not tend to untwist.

From the post former unit 16, the wire is directed to the pulling capstan 167 and from the capstan is, in turn, directed upwardly to a guide sheave 182. Intermediate the guide sheave 182 and the capstan 167, there is provided a control device or gaging unit 17. This unit, as most clearly shown in Figs. 8 and 9, comprises a suitable switch mechanism 183 for interrupting the power supply to the motor 19 when an undesirable lump or kink occurs in the cable 178. The switch 183 has an actuator arm 184 extending from it, which is spring biased in any suitable manner to remain in the position shown in Fig. 8. Mounted on the end of the actuator arm 184 is a roller 185, which lies in the path of a bell crank lever 186. The bell crank lever 186 is pivoted on a pin 187 and has one of its arms in engagement with the roller 185, whereas its other arm has a slot 188 formed in it through which the cable 178 passes. The bell crank lever 186 is freely rotatable about the pin 187, which, in turn, is mounted upon a bracket 189 which

extends upwardly from the bearing 172 and supports the bell crank lever 186 and switch mechanism 183. In the operation of the apparatus, a gage sleeve 190 is placed on the cable and normally rides on the cable between the capstan 167 and the bell crank lever 186. The central aperture 191 of the gage sleeve is of a diameter such that cable 178, with the proper contour and size, will pass freely through the sleeve but when a kink or irregularity in the cable engages the sleeve 190, it will move the sleeve upwardly with it in the direction of the arrow (Fig. 8) to overcome the spring pressure of the switch mechanism 183 and cause the actuator lever 184 to be rocked in a clockwise direction when bell crank lever 186 is rocked in a counter-clockwise direction (Fig. 8) by the sleeve 190, thereby to interrupt the operation of the driving motor 19 and stop the apparatus.

After passing over the guide sheave 182, the cable passes to a distributor sheave 193 and thence to a takeup reel 194. The distributor sheave 193 may be moved transversely of the takeup reel 194 by any suitable mechanism, for example, a screw type traverse rod 195. The takeup reel 194 and traverse rod 195 are driven by the shaft 22 through any suitable speed reduction mechanism, such as that illustrated at 196.

A better understanding of the invention may be had by reference to the following brief description of the operation of the apparatus. In starting the apparatus, wires may be withdrawn from each of the supply spools 85 to 91, the wire from spool 91 being entered directly into the lay plate 92, whereas the wires from the other wire supply spools on the cradle 66 will be drawn therefrom, first passing over guide sheave 151 and then down to tension controlling guide sheave 153 and up to their respective idler guide members 160. From the idler guide members 160, the wires may be fed through the lay plate 92 and the stranding die 64, after which the group of wires may be directed through the guide member 51 and over guide sheaves 53 and 40 to the guide pulley 37. From the guide pulley 37, the wires are directed to the post former sheave 175 and thence through the rotatable member 171, which is in alignment with the capstan 167. The wires are wrapped several times around the capstan 167 and then passed through the gage sleeve 190 and over sheaves 182 and 193 to the takeup reel 194. After the apparatus has been prepared in this manner and the ends of the wires have been suitably secured to the takeup reel 194, motor 19 may be started in operation to drive the flyer arms 38, 39, 54 and 55 to cause two twists to be put in the wire for each revolution of the flyer between the lay plate 92 and the post former unit 16. The speed of rotation of the capstan 167 and takeup reel 194 will determine the number of lays or twists of wire per foot length of cable 178 and the wires will be twisted exactly as tightly as is desired in the ultimate cable by the flyer. Then, due to the action of the post former unit 16, the cable will be overtwisted between the post former and flyer and will be untwisted between the post former and capstan 167, so that when the cable reaches the capstan, it will have the required twist as applied by the flyer and will still be "dead" and will not tend to untwist as it is fed to and wrapped around the takeup reel 194.

If there is a tendency for the wire to be drawn from any one of the spools 85 to 90 under less than the desired tension, the sheave 153 associated with that spool will move downwardly and, in so doing, will rock the sheave supporting framework 141 about the rod 137. When the sheave supporting framework 141 is rocked downwardly, the threaded rod 132 will be drawn toward the center of the cradle 66 and will, therefore, rock the brake arm 128 towards its associated brake drum 125 to retard the rotation of the supply spool with which it is associated. Similarly, if the braking pressure of the brake block 127 on the brake drum 125 exceeds the desired amount, the sheave supporting framework 141 associated with that particular wire supply spool will be rocked upwardly to release the brake arm 128 from the brake drum an amount corresponding to the amount that the sheave supporting framework is rocked out of its normal position. Thus, the tension on the wires being drawn from the supply spool may be maintained substantially constant and the guide sheaves 153 and 151 will slide back and forth on their respective rods 144 and 152 to withdraw the wire evenly from the supply spools. The tension on the strands of wire will thus be maintained constant and formation of the cable will be continued until the supply of wire on the supply spools is exhausted, at which time the operation of the machine may be stopped manually. However, if a kink or other irregularity occurs in the cable, the machine will be automatically stopped by the kink or other irregularity engaging the gauge sleeve 190 and carrying it upwardly to actuate the switch 183 to interrupt the supply circuit to motor 19.

What is claimed is:

1. An apparatus for twisting strands into a cable comprising a cradle for supporting a supply of strands, a flyer rotatable around said cradle to impart two twists to the strands as they are withdrawn from the supplies on the cradle, a capstan for pulling the strands from the supplies and over the flyer, and a post former interposed between the flyer and the capstan for applying a twist to the cable between itself and the flyer and for untwisting the cable between itself and the capstan.

2. In a strand twisting apparatus, a cradle, a plurality of spools containing strands wound thereon supported by said cradle, a flyer rotatable around said cradle, a guide passage through a portion of said flyer, a guide plate for directing strands from the supplies to said passage in the flyer, an idler roller positioned between the guide plate and the supplies of strand for directing the strands to the guide plate, and a pair of freely rotatable and freely slidable sheaves cooperating to guide a strand from a supply to the guide roller.

3. In a strand twisting apparatus, a cradle, a plurality of spools containing strands wound thereon supported by said cradle, a flyer rotatable around said cradle, a guide passage through a portion of said flyer, a guide plate for directng strands from the supplies to said passage in the flyer, an idler roller positioned between the guide plate and the spools of strand for directing the strands to the guide plate, a pair of freely rotatable and freely slidable sheaves cooperating to guide a strand from a spool to the guide roller, an oscillatable sheave supporting framework for supporting one of said freely rotatable and slidable sheaves, and means actuated by the sheave supporting framework for controlling the tension in the strand.

4. In a strand twisting apparatus, a cradle, a

plurality of spools containing strands wound thereon supported by said cradle, a flyer rotatable around said cradle, a guide passage through a portion of said flyer, a guide plate for directing strands from the supplies to said passage in the flyer, an idler guide roller positioned between the guide plate and the supplies of strand for directing the strands to the guide plate, a pair of freely rotatable and freely slidable sheaves cooperating to guide a strand from a spool to the guide roller, a sheave supporting framework for supporting one of said freely rotatable and freely slidable sheaves, means for normally urging said framework to a predetermined position, and means operable under control of said framework for maintaining the tension in a constant.

5. A tension controlling device for a strand handling apparatus comprising a brake, a means for controlling said brake including resilient means for normally urging said brake to apply a predetermined braking force, a lever for varying the effectiveness of said resilient means, a framework connected to said lever for actuating it, and a sheave freely rotatable and slidable with respect to said framework, said sheave being responsive to the tension in a strand being handled to control the braking force applied to the strand supply.

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