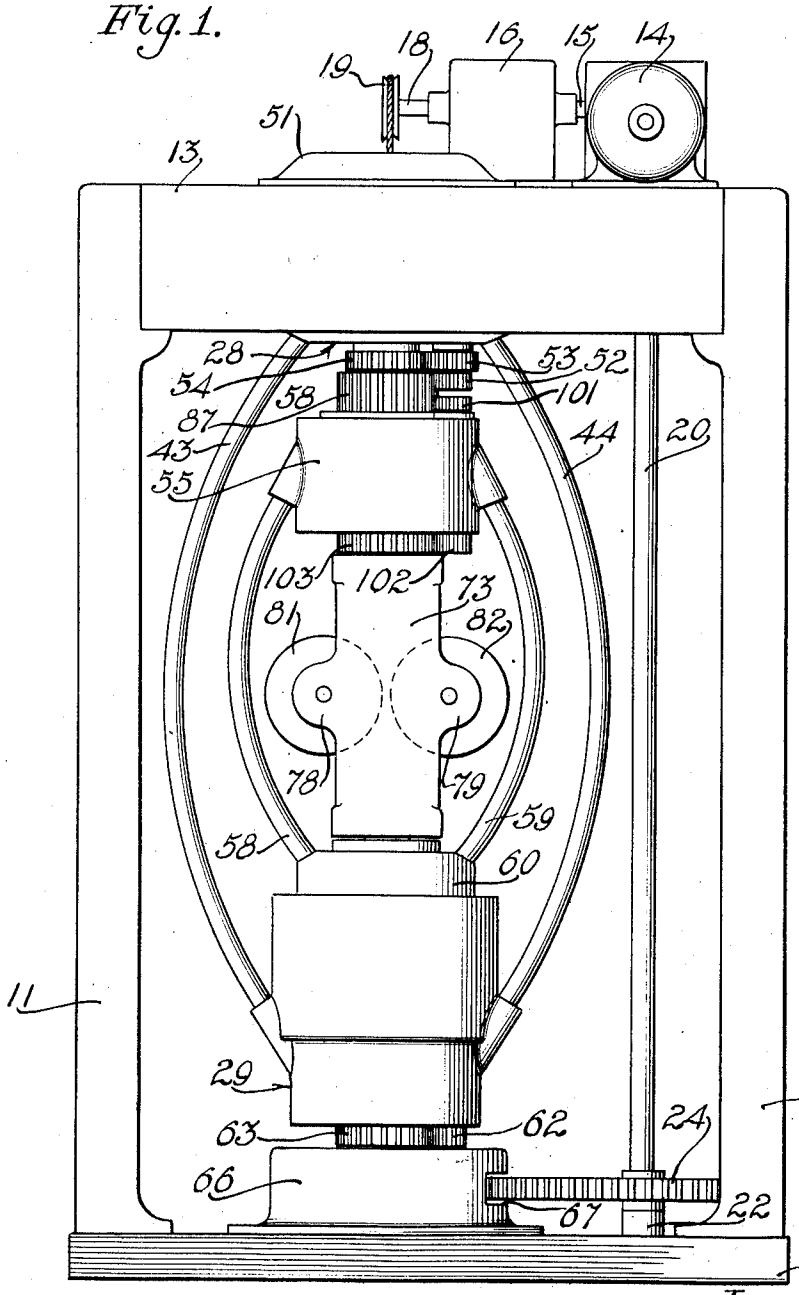
Nov. 6, 1928. 1,690,373

A. MARCHEV

METHOD OF AND APPARATUS FOR TWISTING STRANDS

Filed Nov. 14, 1924 3 Sheets-Sheet 1

Fig. 1.



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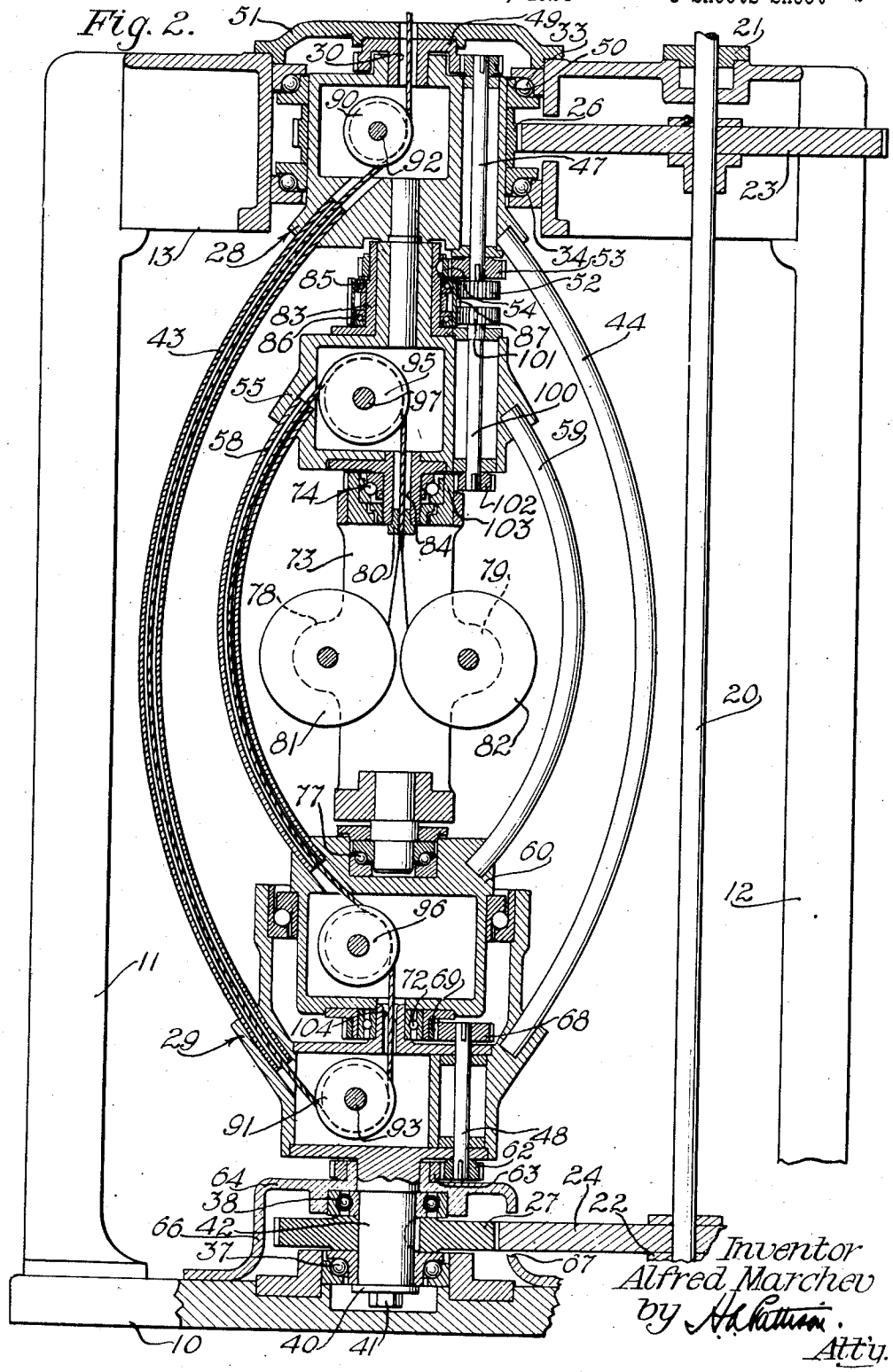
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METHOD OF AND APPARATUS FOR TWISTING STRANDS

Filed Nov. 14, 1924 3 Sheets-Sheet 2

Fig. 2.



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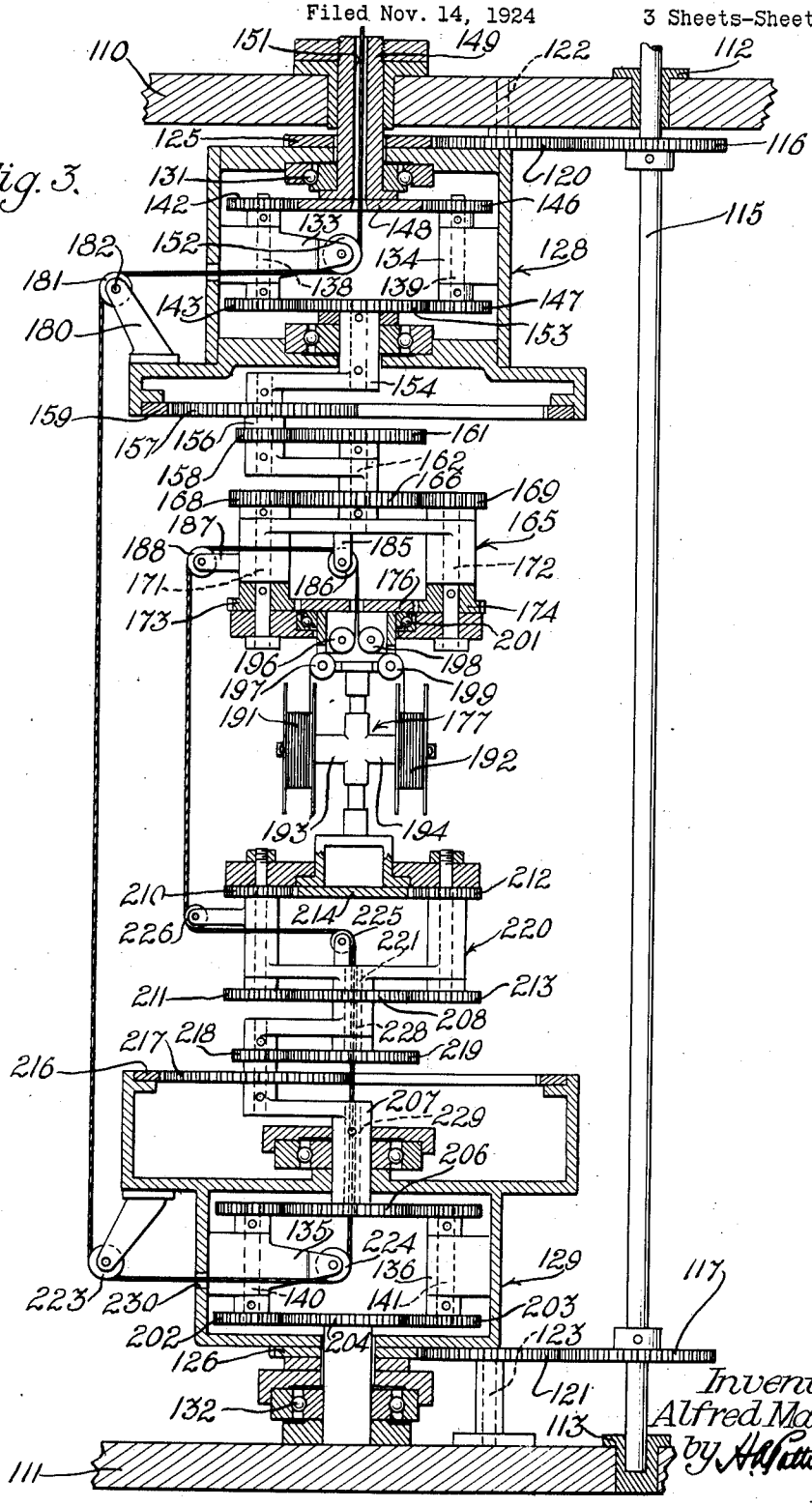
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Fig. 3.



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UNITED STATES PATENT OFFICE.

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METHOD OF AND APPARATUS FOR TWISTING STRANDS.

Application filed November 14, 1924. Serial No. 749,833.

This invention relates to an improved method of and apparatus for twisting strands.

The principal object of the invention is to provide an improved method of rapidly twisting strands.

A further object of the invention is to provide an improved mechanism for practicing the improved method.

According to the main feature of the invention the strands to be twisted are formed into a plurality of non-concentric looped portions and these non-concentric loops are then rotated about a common axis in opposite directions, the strands being simultaneously advanced along the path of the loops. The improved mechanism comprises a rotatable supply reel bracket and a pair of balanced fliers, means being provided for causing a relative movement of said fliers while the supply reel bracket is held stationary by associated means. The assembled strands are led through the fliers and the rotation of these fliers in opposite directions produces four twists in the strands for each cycle of the mechanism. In another embodiment of the invention the strands are held between guide sheaves which project from upper and lower heads which revolve at the same speed. The strands bow out as the mechanism is set in motion, but no tube or other guiding means is provided between the sheaves.

Other objects and features of the invention will become apparent from the following description taken with the accompanying drawings showing apparatus embodying the invention and by which the method may be accomplished, in which

Fig. 1 is a front elevation of a strand twisting machine in which features of the invention are embodied;

Fig. 2 is an enlarged vertical sectional view of a portion of the mechanism shown in Fig. 1, and

Fig. 3 is a sectional detailed view showing another embodiment of the invention.

It is believed that a complete understanding of the improved method will be procured from a description of the apparatus by which it may be performed.

Referring now to the accompanying drawings in which like numerals are employed to designate similar members throughout the several views, particularly to Figs. 1 and 2 showing a specific embodiment of the invention, the frame of the twisting mechanism consists of a base 10, uprights 11 and 12 and an upper cross rail 13. An electric motor 14 is suitably mounted on the upper cross rail 13, its shaft 15 being connected with a train of gears enclosed in a housing 16, and a shaft 18 connected with the gears in the housing 16 is adapted to drive a capstan 19, whose function will be described later. Suitable gearing (not shown) permits the motor 14 to drive a shaft 20 which is journaled in bearings 21 and 22 and has keyed thereto gears 23 and 24. The gears 23 and 24 engage gears 26 and 27, respectively, which are integral with flier heads 28 and 29, so that rotation of the gears 23 and 24 will cause a rotary movement of the heads 28 and 29. The upper head 28 is provided with suitable ball bearings 33 and 34, while the lower head 29 is provided with bearings 37 and 38 and is mounted securely in position with a washer 40 and a nut 41 which is suitably threaded on a portion of a shaft 42 which is integral with the head 29. A plurality of arms 43 and 44 are mounted between the heads 28 and 29 and revolve with them, and the assembly constitutes one flier of the machine. One of these arms carries the strands to be twisted, as will be described later, and the opposite arm is for the purpose of balancing the flier. A pair of floating shafts 47 and 48 are journaled in suitable bearings in the heads 28 and 29, respectively.

Sheaves 90 and 91 whose function will be explained more in detail hereinafter are mounted on the heads 28 and 29, respectively, by means of pins 92 and 93, the wire guided by the grooves of said sheaves being coincident with the axis of rotation of the heads on which the sheaves are mounted. A bored out portion 30 in the head 28 is also coincident with the axis of rotation of the head 28 and with the inner guiding surface of the sheave 90. A channel 104 in the head 29 is also coincident with the axis of rotation of the heads as described above.

The upper and lower sections of the mechanism are somewhat differently arranged and will now be described separately. Planetary gearing is associated with the head 28 as follows: The floating shaft 47 which is journaled in the upper head 28 is provided at its upper end with a pinion 50 which meshes with a gear 49 which is integral with a mem-

ber 51 which acts as a cover for the cross rail 13 to which it is integrally secured. The opposite end of the floating shaft 47 is provided with a pinion 52, the function of which will be hereinafter described, and with a somewhat larger pinion 53 which meshes with a gear 54 which is integral with an inner flier head 55. The pinions 50 and 53 being of a suitable ratio, the inner head 55 is caused to rotate in an opposite direction to the head 28 at the same speed thereof. A plurality of inner arms 58 and 59 are interposed between the inner flier head 55 and another inner flier head 60.

The two inner heads 55 and 60, together with the inner arms 58 and 59 constituting together an inner flier, revolve integrally. One of these arms carries the strands to be twisted and the other arm simply balances the mechanism to permit smooth movement without vibration. In order to prevent tension upon the arms and to permit them to be made sufficiently light so that they can be revolved at a high speed, positive driving means for the flier at the lower inner head 60 is provided. As heretofore described a floating shaft 48 is journaled in suitable bearings in the head 29. This floating shaft is provided at its lower end with a pinion 62 which meshes with a gear 63 which is integral with a ring member 64 which is held integral with the base 10 by a housing 66 which is cut away at 67 to permit meshing of the gear 24 and the gear 27. A somewhat larger pinion 68 is keyed to the upper end of the floating shaft 48 and meshes with a gear 69 which is integral with the head 60. The head 60 is held in spaced relation from the head 29 by a suitable ball bearing 72. A wire guiding tube 80 is secured in a bored out portion 84 in the head 55, and the bored out portion 84 together with the tube 80 are parallel to and in line with the axis of rotation of the head 55.

Sheaves 95 and 96, the purpose of which will be explained more in detail hereinafter, are mounted on the inner flier heads 55 and 60 by means of pins 97 and 98, a wire guided by the grooves of these sheaves being coincident with the axis on which the inner heads 55 and 60 revolve.

The portions of the mechanism described in the preceding paragraph, have primarily for their object the causation of the proper relative movement between the several moving parts. A non-rotating member 73 for supporting supply reels is mounted between the inner heads 55 and 60 and is held in its mounted position by a radial ball bearing 74 and a combination radial and thrust bearing 77. A plurality of projecting portions 78 and 79 are provided thereon for mounting supply reels 81 and 82.

The reel support member 73 is held in proper relative position to the moving members by planet gears in the following manner: The lower pinion 52 which is keyed to the floating shaft 47 meshes with a gear 87 integral with a collar 83, which collar rides on a portion of the head 55, suitable bearings 85 and 86 being provided to permit free movement therebetween. The gear 49 being stationary and the pinions 50 and 53 having a ratio of 1 to 1 the collar 83 is also held in a stationary position. Planetary gearing between the collar 83 and the reel support member 73 causes the latter member to be held stationary in the following manner: A floating shaft 100 is journaled in suitable bearings in the inner head 55 and is provided with pinions 101 and 102 having a ratio of 1 to 1, the pinion 101 meshing with the beforementioned gear 87 of the collar 83, and the pinion 102 meshing with a gear 103 which is integral with the reel support member 73. The gear 87 on the collar 83 being held in a stationary position and the ratio of the pinions 101 and 102 being as described, the gear 103 together with the reel support member 73, which is integral therewith, are also held stationary.

The operation of the mechanism shown in Figs. 1 and 2 and described above is as follows: After the reels have been placed in their proper positions on the reel support member 73, the wires therefrom are assembled and passed through the wire guiding tube 80. The assembled wires are then led over the sheave 95, down through the hollow arm 58, over the sheave 96, through the channel 104, around the sheave 91, through the hollow arm 43, and over the sheave 90 in the manner shown more in detail in Fig. 2 of the attached drawing. The assembled wires are then led through the bored out portion 30 and around the capstan 19 to a suitable take-up mechanism (not shown). The assembled wires are advanced through the moving parts of the mechanism and over the sheaves as described, and the wires are twisted together while being advanced in the following manner: As described, the heads 28 and 29, together with the arms 43 and 44, rotate as a single unit, the inner heads 55 and 60 with the arms 58 and 59 also revolve as a single unit at the same speed as the first mentioned single unit, but in an opposite direction, and the reel support member 73 together with the assembly thereof is held in a stationary position with respect to the framework of the machine. The wires to be twisted being held against lateral movement at the tube 80 and the sheave 95, one complete twist is put in the wire between these points for each revolution of the mechanism. The sheaves 96 and 91 rotating in opposite direction and also holding the wires against lateral movement at these two points a double twist is produced in said wires between these two sheaves. The fourth and final twist is put in the wire between the last sheave 90

and the take-up capstan 19, the wire being held against lateral movement at these two points also. It will be seen, therefore, that in the particular embodiment of the invention shown, the wires receive four complete twists for each cycle of the twisting mechanism, or two twists for each flier used.

Referring now to the embodiment shown in Fig. 3 an upper cross member 110 and a base member 111 (both shown partly cut away) are provided with suitable bearings 112 and 113 to support a shaft 115 which may be connected to a suitable source of power (not shown). Gears 116 and 117 are keyed to the shaft 115 and mesh with gears 120 and 121, respectively, which are rotatably mounted on shafts 122 and 123, respectively, which shafts are secured by suitable means to the framework of the machine. The gears 120 and 121 mesh with gears 125 and 126, respectively, which are integral with heads designated generally as 128 and 129, respectively. The rotation of the shaft 115 is therefore adapted to cause through the train of gears shown, a similar directional rotation of the heads 128 and 129. Suitable bearings, such as ball bearings 131 and 132 are provided to facilitate the rotation of these heads. A plurality of lugs 133 and 134, 135 and 136 are integral with the interior wall of the heads 128 and 129, respectively, and have journaled therein shafts 138, 139, 140 and 141.

In the upper section of the twisting mechanism pinions 142 and 143 are keyed to the shaft 138, while pinions 146 and 147 are keyed to the shaft 139, the two pinions 142 and 146 meshing with a gear 148 which is integral with a stationary member 149 which is rigidly secured to the upper cross member 110. A bore 151 extends through the stationary member 149 and the gear 148 and forms a passageway for assembled wires as will be hereinafter described. A sheave 152 is suitably mounted on the head 128 so that assembled wires on the inside guiding face thereof are substantially coincident with the axis of rotation of the head 128.

An aperture in the head 128 is substantially parallel to the sheave 152 and is adapted to permit a wire to be led therethrough as is described hereinafter. An upwardly projecting member 180 is rigidly secured to the head 128 and is bifurcated to receive a guiding sheave 181 which is held in position by a pin 182.

The gearing employed in the embodiment is substantially like the planetary gearing described for the embodiment previously described. This may be called simple epicyclic gearing and it will now be described in detail.

The two pinions 143 and 147 referred to above mesh with a gear 153 which is integral with an arm 154 and the gear 153 together with the arm 154 are adapted to be held stationary through the action of the train of gears 143 and 142 and 147 and 146 which have a ratio to each other of 1 to 1, respectively, and which engage a gear 148 which is integral with the stationary member 149 as described. A sleeve 156 on the arm 154 carries integral therewith a gear 157 and pinion 158, the gear 157 meshing with an internal gear 159 which is integral with the head 128 and the pinion 158 meshing with a sun gear 161 which is integral with a shaft 162 which is journaled in the arm 154, which shaft 162 is also integral with an inner flier head generally designated as 165 which the shaft 162 is adapted to drive through the train of gearing described. The relationship of these gears is such that the rotation of the head 165 will be opposite to that of the head 128, but at the same speed thereof.

A gear 166 integral with the arm 154, meshes with pinions 168 and 169 which are integral with shafts 171 and 172 which are journaled in the head 165. A pair of pinions 173 and 174 having a ratio of 1 to 1 to the pinions 168 and 169, respectively, engage a gear 176 which is integral with a reel support member 177, the rotation of the head 165 causing the pinions 168 and 169 to revolve around the stationary gear 166, and the ratio of the pinions being as described, the gear 176 together with the reel support member 177 are likewise held stationary.

A member 185 projecting downwardly from the inner head 165 is bifurcated to receive a guide sheave 186, and another member 187 projecting from the inner head 165 at right angles to the axis of rotation thereof, carries a sheave 188 which will be referred to more in detail hereinafter.

A plurality of supply reels 191 and 192 may be rotatably mounted on the reel support member 177 by means of a plurality of projections 193 and 194. A plurality of guiding sheaves 196, 197, 198 and 199 are secured by suitable means to the reel support member 177, and an aperture in the center of the gear 176 which is associated with said reel support member permits passage therethrough of assembled wires as shown. Suitable bearing means such as a ball bearing 201 is provided between the inner head 165 and the reel support member 177.

The lower part of the mechanism as shown in Fig. 3 is substantially the same as the upper part which was described in detail in the preceding paragraphs. The arrangement of bearings, sheaves and the like varies on account of the direction of passage of the assembled wires as they are being twisted and on account of the necessity of rearranging somewhat the bearing surfaces. The rotation of the lower head 129 causes a rolling of pinions 202 and 203 on a gear 204 which is held against rotation by suitable means. A train of gears such as that described for the upper part of the mechanism causes to be

held stationary a gear 206 and an arm 207 with a gear 208 which is integral with the arm 207, whereby through another train of gears 210, 211, 212, 213 and 214, the reel support member 177 is likewise held against rotation. An internal gear 216 meshes with a gear 217 which drives a pinion 218 which is integral therewith causes rotation of a sun gear 219 which drives a lower inner head 220 by means of a shaft 221 journaled in a portion of the arm 207, which shaft 221 is integral with the gear 219, as well as with the lower inner head 220. Sheaves 223, 224, 225 and 226 are suitably placed, as shown clearly in the drawing, to furnish guiding means for the assembled wires. An aperture 228 extending through the shaft 221 and the gear 219 permits passage of wires therethrough, while a similar aperture 229 through a portion of the arm 207 and the center of the gear 206 and still another aperture 230 through the wall of the lower head 129 answer the same purpose.

In this embodiment of the invention, the operation is as follows: When the supply reels 191 and 192 have been placed in position, the wires are drawn over the guide sheaves 196, 197, 198 and 199, assembled at the sheave 186 and then led over sheaves 188, 226, 225, 224, 223, 181, respectively, and out through the bore 151, as shown clearly in the drawing. The assembled and twisted wires are then taken up on suitable take-up mechanism (not shown in any of the figures). The sheaves 181, 223, 188 and 226 take the place of the arms in the other embodiment of the invention as shown in Figs. 1 and 2.

In the particular embodiment of the invention, now being described, one twist is made in the wires between the sheaves 196 and 198 and the sheave 186. Two twists are made in the wires between the sheaves 225 and 224, while the last and final twist is made in the wires between the sheave 152 and the take-up capstan. In this form of the mechanism, therefore, four twists are given to the wire for each cycle of the mechanism.

What is claimed is:

1. A method of twisting strands which consists in passing said strands successively through a plurality of fliers in such a manner as to form of said strands a plurality of arcuated sections, and positively revolving both ends of said plurality of fliers to cause a twisting of the strands.

2. In a strand twisting mechanism, an outer and an inner flier, a rotatably mounted member for storing strands, means for causing said fliers to rotate in opposite directions to produce twists in said strands, and planetary gearing for maintaining said rotatably mounted member stationary.

3. In a strand twisting mechanism, a rotatably mounted member for storing strands, means for holding said member stationary, a plurality of operatively interconnected fliers, means for holding a plurality of strands in association with said fliers, and planetary gearing for causing a relative movement of said fliers, thereby causing a twist of said strands.

4. In a strand twisting mechanism, a rotatably mounted member for storing strands, a plurality of operatively interconnected fliers, and means for driving both ends of said fliers.

5. In a strand twisting mechanism, a rotatably mounted member for holding strands, a plurality of operatively interconnected fliers, a capstan for drawing strands from said rotatably mounted member and associating said strands with said fliers, and means for driving both ends of each of said fliers to produce a twist in said strands.

6. In a strand twisting mechanism, a rotatably mounted member for storing strands, a plurality of operatively interconnected fliers, means for driving both ends of said fliers, and means associated with the last-mentioned means for holding said member stationary.

7. In a strand twisting mechanism, a rotatably mounted member for storing strands, a plurality of operatively interconnected fliers, means for driving both ends of said fliers, and planetary gearing for holding said member stationary.

8. In a strand twisting mechanism, an inner and outer flier, means for causing a direct drive for the outermost of said fliers, and planetary gearing associated with the outermost of said fliers to cause an opposite rotation of an inner one of said fliers.

9. In a strand twisting mechanism, a rotatably mounted member for storing strands, a plurality of coaxially positioned fliers, means for holding a plurality of strands in association with said fliers, and means for causing a relative movement of said fliers to cause a twist of said strands.

10. In a strand twisting mechanism, a flier, means for positively driving said flier an inner flier disposed coaxially to the first-mentioned flier, and planetary gearing to cause a rotation in an opposite direction of said inner flier.

11. In a strand twisting mechanism, a flier, means for positively driving said flier, an inner flier disposed coaxially to the first-mentioned flier, planetary gearing to cause an opposite rotation of said inner flier, and a member rotatably mounted within said inner flier for storing strands.

12. In a strand twisting mechanism, a flier, means for positively driving said flier, an inner flier disposed coaxially to the first-mentioned flier, planetary gearing to cause an opposite rotation of said inner flier, a member for storing strands rotatably mounted within said inner flier, and planetary gear-

ing associated with said first-mentioned planetary gearing for holding said member stationary.

13. In a strand twisting mechanism, a rotatably mounted member for storing strands, a plurality of pairs of oppositely disposed members, each pair being adapted to revolve together and opposite to each other pair, and epicyclic gearing to cause relative movement between said pairs of members and to hold said rotatably mounted member stationary.

In witness whereof, I hereunto subscribe my name this 31st day of October A. D., 1924.

ALFRED MARCHEV.