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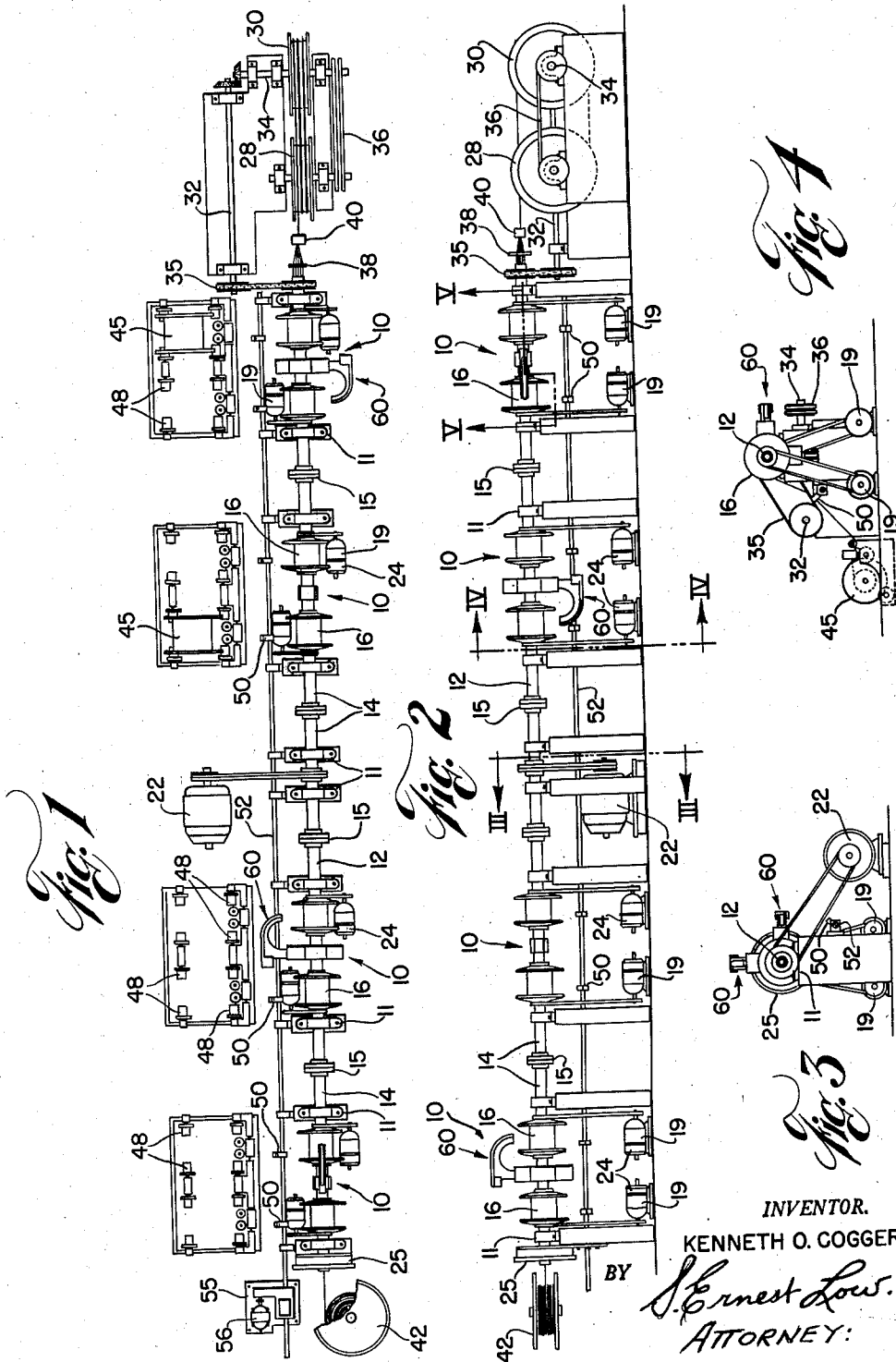
K. O. COGGER

2,826,035

STRANDING MECHANISMS

Filed Aug. 5, 1954

3 Sheets-Sheet 1



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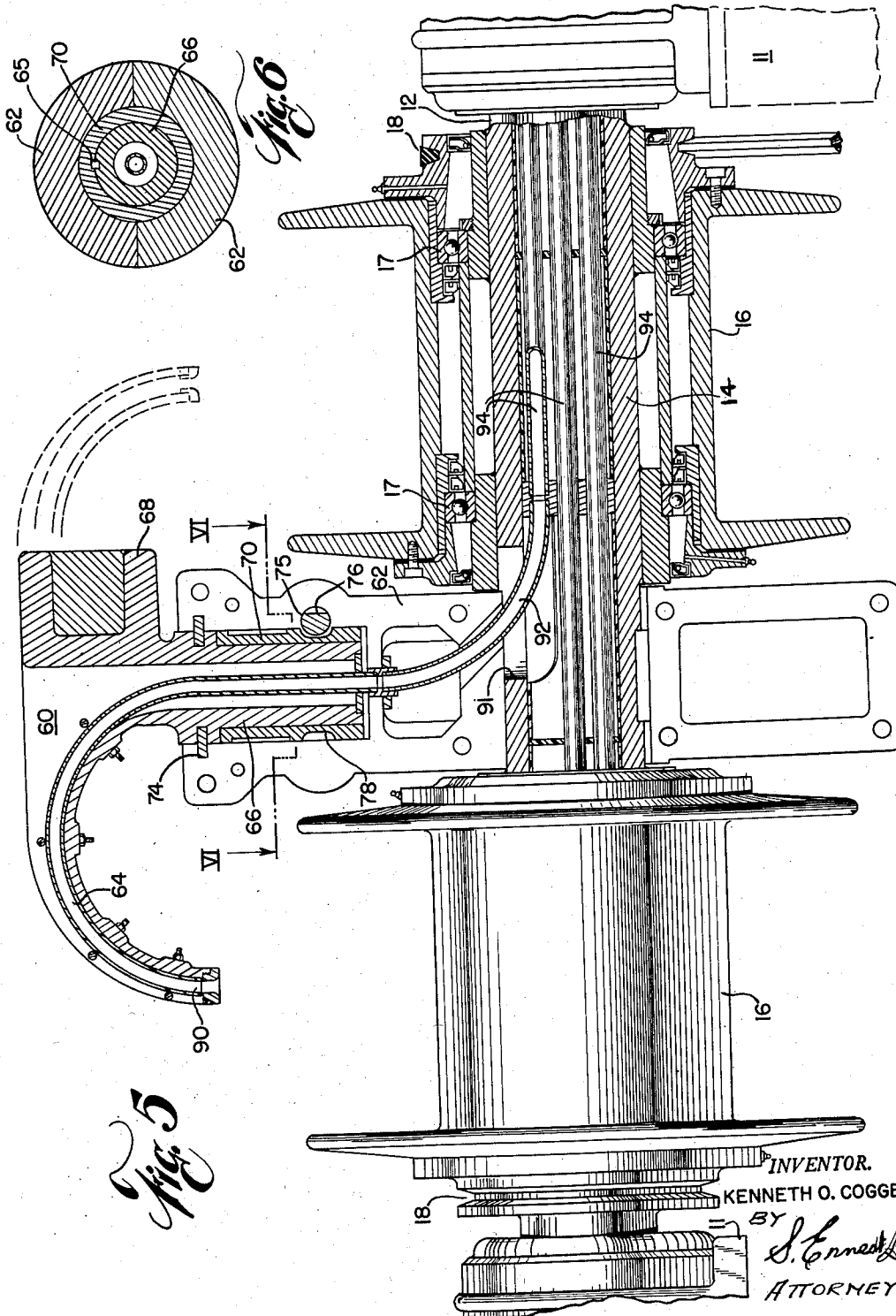
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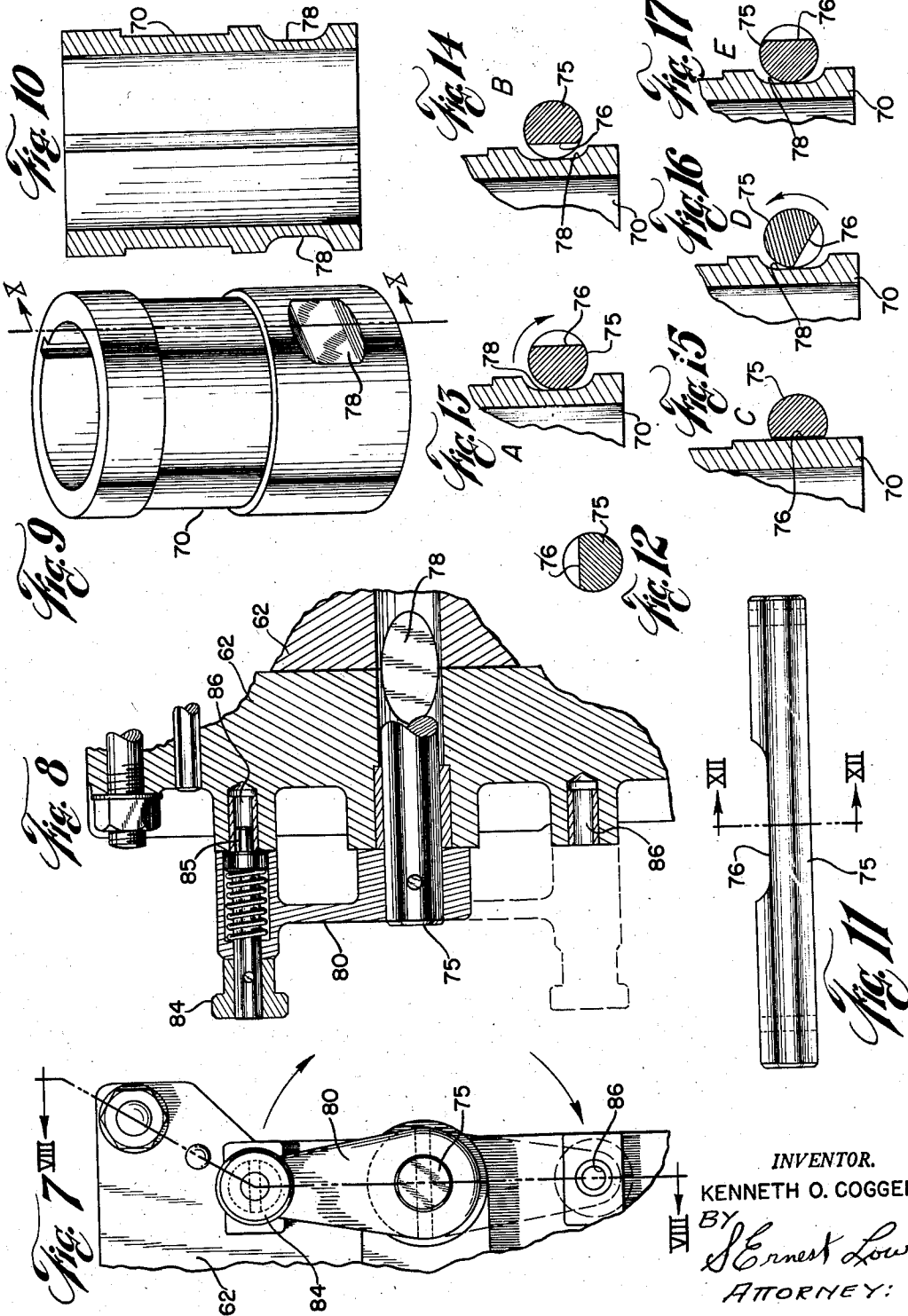
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3 Sheets-Sheet 3



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STRANDING MECHANISMS

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5 Claims. (Cl. 57—17)

This invention relates in general to stranding equipment and more particularly to high speed stranding mechanisms suitable for the production of stranded or twisted wire cable, rope and the like.

The type of equipment contemplated within the scope of the invention is generally termed tandem stranding mechanism, as distinguished from planetary devices, and is generally characterizable by an arrangement of a plurality of pay-off, strand-supplying reels or spools mounted on a common axis, through which a central single strand or stranded cable, rope or the like may be supplied, and about which common axis strands from the supply reels are helically twisted in the formation of a multi-strand cable product.

It is one object of the invention to provide a compact tandem type stranding mechanism which will permit operating speeds in excess of present commercial practice.

It is another object of the invention to provide a tandem strander which insures a substantially constant supply of material to be stranded or made up into helically twisted cable with minimum interruption in the operating cycle of the strander.

A further object of the invention, in more specific terms, is the provision of a tandem wire stranding mechanism incorporating at least one pair of reels or spools serving as a pay-off and a supply or stand-by reel or spool for each of the strands to be helically twisted and laid in a finished cable, the reels or spools being positively driven in the same direction of rotation on a common axis with one reel of each pair paying off a wire strand while the second reel of the pair is simultaneously being built-up or loaded with strand material for subsequent pay-off on depletion of the strand material on the first reel of the pair.

Other objects and advantages will be apparent and understood by those skilled in the art following consideration of the description and appended drawings, in which:

Fig. 1 represents a top plan view of a tandem stranding mechanism constructed in accordance with the invention;

Fig. 2 represents a side elevational view of the equipment illustrated in Fig. 1;

Fig. 3 represents a sectional elevation taken on the plane III—III of Fig. 2;

Fig. 4 represents a sectional elevation taken on the plane IV—IV of Fig. 2;

Fig. 5 represents a fragmentary partial sectional elevation to enlarged scale of a portion of the mechanism of Figs. 1 and 2 taken on the plane V—V of Fig. 2;

Fig. 6 represents a cross-sectional view taken on the plane VI—VI of Fig. 5;

Fig. 7 represents a fragmentary elevational view to enlarged scale of a locking device forming a part of the mechanism of the invention;

Fig. 8 represents a sectional elevational view taken on the plane VIII—VIII of Fig. 7;

Fig. 9 represents a view to enlarged scale of a cylindrical

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sleeve member incorporated in the mechanism illustrated in Fig. 5;

Fig. 10 represents a sectional elevation taken on the plane X—X of Fig. 9;

Fig. 11 represents a view to enlarged scale of a cylindrical locking pin incorporated in the mechanism illustrated in Fig. 5;

Fig. 12 represents a sectional elevation taken on the plane XII—XII of Fig. 11; and,

Figs. 13 through 17 represent fragmentary sectional elevational views illustrating five separate operational positions of the locking pin of Fig. 11 in its association with the cylindrical sleeve member of Figs. 5, 8, 9 and 10.

The mechanism of the invention basically comprises a plurality of individual units each consisting of a pair of spools or reels mounted in tandem on a common axis or shaft, the common shaft supporting the reels, as well as the reels themselves, being rotatably driven in the same rotational direction preferably by independent prime movers.

One of the reels in each pair is a pay-off reel in that it supplies material in continuous strand form to a twisting head and lay plate of the strander adjacent its discharge end. The other reel of each pair is a stand-by supply source of strand material and is loaded therewith while the first-mentioned reel is being depleted.

A guide device is located between each pair of reels and is supported on and rotates with the main shaft supporting the reels. The guide device is oscillatable into position to receive strand material delivered from either reel of the pair constituting a unit of the stranding equipment and is provided with positive locking means to positively maintain the same in either of the aforesaid positions.

Strand material drawn from the pay-off reel in each pair of the same is conducted through the guide into a registering tubular conduit within the interior of the main shaft, which is hollow for this purpose, supporting the reels and is drawn therethrough and through the twisting head or lay plate and closing die by the usual cable re-winding mechanism located adjacent the discharge end of the strander. A central strand or stranded cable may also be supplied through the tubular main shaft of the strander, twisting head or lay plate and closing die in which case the previously mentioned strands would be helically twisted and laid on the central strand or cable in the formation of the final composite cable structure. It will be apparent that any one or all of the strands supplied in the manufacture of the final stranded product may be replaced by previously stranded members since the equipment of the invention is adaptable to the manufacture of finished stranded products fabricated from single strands or previously stranded starting material.

Several unique and novel features are incorporated in the integrated tandem stranding mechanism basically described above. For example, any desired number of units, each comprising a pay-off and a supply reel, may be selected by coupling or uncoupling two-reel units in the equipment as desired, the number of units in any particular case corresponding to the number of external, helically twisted strands desired in the finished stranded product. Each reel of each pair of the same constituting a unit, and the main shaft supporting the reels, are driven independently of each other and at relatively different speeds, preferably by means of suitable electric motors. In the preferred construction and operation of the strander of the invention each reel of each pair is driven through a constant torque or constant tension drive and may incorporate fluid drive type power transmitting mechanism.

A further unique feature of the equipment of the in-

vention is the direction of rotation of the pay-off and supply reels and main shaft supporting the same. It will be observed that it has been stated that the supply and pay-off reels of each unit are driven in the same direction as the main drive shaft supporting the same. In the practice of the invention the pay-off reel is also deliberately driven at a relatively slower speed than the main drive shaft to which the strand guiding device is fixedly attached, the operation of the mechanism being so controlled that the speed of a pay-off reel relative to the speed of the main drive shaft supporting the same is expressible by the equation:

R. P. M. of pay of reel =

$$1 - \frac{\text{Length of strand required for one complete twist}}{\text{Circumference of stranding material on pay-off reel}} \times$$

R. P. M. of main drive shaft

which results in a positive back tension on the strand material delivered by a pay-off reel or spool. This relative speed relationship and back tension feature are readily accomplishable through the use of constant torque electric motors with or without interposed fluid or similar power coupling mechanism in the separate prime movers driving each reel and its common supporting shaft. The back tension developed in a payed off strand is actually attributable to the increased speed of rotation of the main shaft rotatably supporting the pay-off reel and fixedly carrying the strand guiding device, as compared to the slower constant torque driven pay-off reel, the work expended to create this condition reverting to the pay-off reel constant torque drive in the form of slip.

A significant advantage resulting from the provision and use of the mechanism of the invention is attributable to the relatively low WR^2 of the equipment, permitting its rapid acceleration and deceleration for any cause, where W equals the weight and R equals the radius of gyration of the rotatable elements of the equipment. For example, strand breakage dictates this desirable characteristic in stranding equipment, and the fact that the pay-off and stand-by supply reels are driven in the same direction prevents unnecessary throwing of large amounts of stranding material following a break in one or more of the wires or other strands drawn through the strander.

The equipment of the invention will now be described in more detail with reference to the drawings. It will be observed from Figs. 1 through 4 that the stranding mechanism has been illustrated in terms of four two-reel units 10 coupled together in tandem on a common main shaft 12. The shaft 12 is selected in tubular form, for purposes to be more definitely described hereinafter, and is preferably composed of separate sections 14 supported in axially aligned relationship in pedestal type bearings 11, the sections 14 being otherwise flexibly coupled at 15 in such a manner that units 10 may be added to or removed from the strander as desired. The reels 16 of each unit are identical in their construction and are rotatably mounted in respect and relative to the shaft section 14 supporting the same by means of suitable anti-friction type bearings 17, shown to best advantage in Fig. 5.

Each reel 16, as well as main shaft 12, is independently driven in the same angular direction of rotation by means of its own individual prime mover. In the case of the reels 16, each is equipped with a sheave 18, secured to the outer race of one of its anti-friction bearings 17, which is belt connected to an electric motor 19. A main shaft electric motor 22 is also provided in belt and sheave connection to the shaft 12.

Selection of constant torque electric motors 19 insures realization of certain of the basic advantages of the invention, as will be hereinafter more clearly pointed out, or a mechanical or fluid coupling slip clutch mechanism may be incorporated between each prime mover and the

reel 16 driven thereby to provide constant torque characteristics for the individual driving means for each of the reels, it being understood that the prime mover or electric motor 22 driving the main shaft 12 is always actuated at a speed in excess to the speed of the reels 16, as expressed in the formula appearing in the preceding general description of the invention.

Selection of electric motors 19 and 22, respectively, as the motivating means for the reels 16 and main shaft 12 permits employing an integrated, interlocking electrical control system, which will function automatically to interrupt or open any one and simultaneously all of the electrical supply circuits to the reel and main shaft motors as a result of strand or cable breakage, or for any other cause reflected in the normal load on any of the electric motors 19 and 22. To further enhance interruption and stopping of the rotating elements of the mechanism, magnetic brakes 24 mounted on the shaft of each of the reel motors 19, as well as a magnetic brake 25 on the main shaft 12, are automatically energized through interruption in the aforementioned integrated, interlocking electrical control system. Electrical control systems of the type referred to herein are common expedients and have not been specifically illustrated in the drawings.

A snubbing reel or capstan 23 and a rewind or take-up reel 30 are provided as standard equipment for respectively tensioning and coiling a finished stranded product at the discharge end of the strander, the snubbing and coiling mechanism being suitably driven by miter gear connected jack shafts 32 and 34, sheave and belt connected at 35 to the main shaft 12, with the further belt and sheave connection 36 interconnecting the respective supporting shafts of snubbing reel 23 and take-up reel 30. In addition, the basic tandem strander includes a twisting head or lay plate 38, suitably secured to and rotatable with the main shaft 12, and a stationary closing die 40 in direct alignment with the axis of the main shaft 12. In the event it is desired to fabricate a stranded product incorporating a central strand or prestranded core member, a supply reel 42 of the central core material is also provided for pay-off into and through the tubular main shaft 12.

Supply reels 45 of strand or previously stranded material to be used in fabricating a finished product in the strander mechanism of the invention are mounted on flanged supporting rollers 48 in basket type cradles adjacent each two-reel unit 10 of the strander. Material is drawn from these reels in the operation of the strander through guides 50 mounted on a horizontally reciprocating shaft or rod 52 of an independently driven fleeter mechanism 55. The fleeter mechanism performs its normal function and uniformly distributes material passing through the guides 50 thereof to uniformly lay strand or previously stranded material on the cylindrical body portions of reels 16. The fleeter mechanism 55 is preferably actuated by an electric motor 56 and as such would be included in the integrated electrical control system previously described.

A guide device or mechanism, represented in its entirety by reference numeral 60, is located between each pair of reels 16. Each guide device comprises a medially split housing 62 key-secured and clamped to its complementary main shaft supporting section 14. The guide mechanism 60 includes an arcuately shaped guide or tubular member 64 provided with an integral tubular cylindrical body portion 66 and integral dynamic balancing weight 68 and is received within and is key connected at 65 to a tubular cylindrical bushing or sleeve 70 positioned within a cylindrical bore in the medially split housing 62. A split ring 74 engages registering grooves in the cylindrical bore in the medially split housing 62 and cylindrical outer surface of the tubular cylindrical portion 66 of the strand guiding device 60 to secure the same in positive assembled relationship. Each strand guiding device 60 is rotatable through 180° in a

plane normal to the axis of the main shaft 12 into position in substantial central registry with each of the reels 16 constituting a pair thereof, as best illustrated in Fig. 5.

A pull pin and locking device is provided for securing each of the strand guiding mechanisms 60 in its two positions as aforescribed. Each locking device comprises a cylindrical rod member 75 with a flat portion 76 intermediate its ends. The rod 75 is positioned within aligned bushed apertures in the medially split housing 62, extends transversely across and through the same and is rotatable therein to bring its flat medial portion 76 into and out of registry with diametrically oppositely disposed flats 78 on the outer cylindrical surface of the cylindrical bushing or sleeve 70.

Rotation of the rod 75 is accomplished through the medium of a crank device 80 pin-connected to an out-board end of the rod 75 (Figs. 7 and 8). The crank is provided with a spring-pressed pull pin mechanism 84 the pilot end 85 of which is receivable within suitable bushed apertures 86 in the medially split housing member 62. The apertures 86 have been illustrated diametrically oppositely disposed in respect to the central and longitudinal axis of the rotatable locking rod 75 and the two positions of the pilot end 85 of the pull pin 84 actually constitute arcuate movement of the rod 75 through 180°. It will be understood that any other angular movement of the rod 75 into and out of registry of its flat surface 76 with the diametrically opposed flat surfaces 78 on the sleeve 70 will be satisfactory.

On reference to Figs. 13 through 17, five positions of the locking rod 75 have been illustrated in its association with the cylindrical sleeve member 70. In Fig. 13 locking rod 75 is shown in position A in which case the cylindrical sleeve 70 is locked within housing 62 to securely position the strand guiding device 60 centrally over one of the reels 16. In Fig. 14 the rod 75 has been rotated clock-wise through 180° from that illustrated in Fig. 13 to position B in which position the cylindrical sleeve 70 is unclamped to permit rotation of the strand guiding device 60 into position over the second pay-off reel 16 of a pair of the same. Fig. 15 shows the locking rod 75 in the same position as in Fig. 14 but during some intermediate rotational position of the cylindrical tubular member 70 termed position C. Fig. 16 illustrates cylindrical sleeve 70 in a position D removed 180° from that illustrated in Fig. 13 with the locking rod 75 being returned to a clamping position on the sleeve 70. In Fig. 17 continued rotation of locking rod 75 has resulted in locking the cylindrical sleeve 70 at a position E removed 180° from the position it occupied in Fig. 13.

In the operation of the stranding mechanism of the invention, it can be assumed that one pay-off reel 16 in one or more of the units 10 supports a supply of material to be stranded into helically twisted cable, rope or the like. Under such circumstances, a strand guiding device 60 would be locked in position in overhanging relationship in respect to the material-carrying reel 16 in each instance. A free end of the material to be stranded is manually drawn off its pay-off reel 16 and threaded into the arcuately curved guide tube 90 supported by the strand guiding device 60. The tubular guide 90 directs its strand into a length of curvilinearly curved tubing 92 projecting through an aperture 91 in the wall of the tubular shaft section 14 into registration with the discharge end of the guide tube 90 and inlet end of one of several guide tube conduits 94 located in circumferentially spaced relationship within the interior of the tubular main shaft 12. Depending on the number of strands to be employed in forming a finished stranded product, each pay-off reel 16 delivers its strand at the discharge end of the strander through the twister head 38, through the stationary closing die 40, around the periphery of the driven capstan or snubbing reel 28, from which it is received, in the form of a finished product,

and coiled upon the driven coiling reel 30. In the event the final product is to be provided with a central strand or prestranded core, this latter element of the final product is drawn through the central tubular shaft 12, central aperture in the twisting head 38, through the stationary closing die 40 and travels with the exteriorly applied or laid strands delivered from the pay-off reels 16 in normal fashion around the snubbing reel 28 to the coiling reel 30.

Simultaneously with the operation of the stranding mechanism, as aforescribed in the fabrication of a final stranded cable, rope or the like, the companion stand-by reel 16 in each pair of reels is loaded or charged with material to be stranded from the supply reel 45 adjacent each unit 10. Depletion of stranding material from any one of the pay-off reels 16 merely entails rapid deceleration and shut-down of the strander by way of throwing a main switch in the integrated electrical control system, aided by the operation of the magnetic brakes mounted on the reel motors and carried by the main shaft 12 of the equipment. As previously stated, this shut-down feature of the strander also functions in the event any one or more of the strands delivered by a pay-off reel 16 is accidentally severed. In this connection the load on the individual reel driving motors 19, as well as main driving motor 22, is immediately reduced as a result of strand breakage, which serves to electrically actuate relay circuits to energize the main shaft magnetic brake 25 and individual reel motor magnetic brakes 24 to decelerate and stop the reel and strander drives. As previously described, rotation of the reels 16, main shaft 12 and strand guiding device 60 in the same direction in the positive relative speed relationship expressed by the preceding formula insures substantial absence of a condition which would entail unnecessary throwing or delivery of stranding material from a pay-off reel 16, and when coupled with the integrated, interlocked electrical control system further insures against any prolonged operation of the stranding mechanism as a result of any breakdown emergency.

The mechanism selected for purposes of illustration is composed of four units 10 and is capable of producing final stranded products incorporating up to four exterior strands helically twisted together with or without an intermediate central supporting strand or prestranded core element. It is also possible to substitute prestranded cable on any one or more of the pay-off reels 16. To increase the number of strands or prestranded elements in a final product over the maximum four exterior strands permissible with the strander of the illustrations, it is only required to add additional units 10 equal in number to the number of exterior strands or prestranded elements required in the final product.

Modifications and changes in the equipment described above will no doubt suggest themselves to those skilled in the art. It is to be understood that the mechanism selected for purposes of illustration is not a limiting factor and that the invention should be given the breadth of protection defined in the claimed appended hereto.

What is claimed is:

1. In a tandem cable stranding mechanism, a strand pay-off reel and a strand build-up reel in axial rotational alignment on a main shaft member, separate driving means for rotating each of the reels and the shaft member in the same angular direction of rotation, the driving means for the pay-off reel being positively controlled to drive at a lower rotational speed than the main shaft member, a strand guiding device disposed between the pay-off and build-up reels and rotatable with the main shaft member, said strand guiding device being oscillatable from a strand receiving position in respect to one of the reels to a similar position in respect to the other of said reels, and locking means for securing the strand guiding device in both positions.

2. In a tandem cable stranding mechanism, a strand

pay-off reel and a stand-by strand build-up reel, said reels being rotatably mounted in axial alignment on a tubular shaft member, a dynamically balanced strand guiding device secured to said tubular shaft member and rotatable therewith in the same angular direction as said reels, said strand guiding device having a strand receiving tubular guide in communication with the interior of said shaft member and extending radially outwardly therefrom and terminating curvilinearly inwardly towards the common axis of said shaft member and reels, said tubular guide being oscillatable to position its curvilinear terminus in strand receiving position adjacent either of said reels, and locking means manipulative to secure the tubular guide against oscillation in either of its selected positions.

3. In a tandem cable stranding mechanism, at least one pair of reels serving interchangeably as strand supplying and strand receiving sources of stranding material, said reels being rotatably mounted on a common main shaft in axial alignment therewith and axially fixed in respect thereto, independent driving means for each reel and the shaft, said driving means being actuated to rotate the reels and shaft in the same angular direction, said pay-off reel driving means being positively controlled at a rotational reel speed lower than the rotational speed of the shaft, means for drawing strand material from the supply reel through the shaft and laying the same in helical form on a central strand drawn through the shaft, a strand guiding device secured to the shaft intermediate the supply and receiving reels and rotatable with the shaft, said strand guiding device being dynamically balanced and incorporating an oscillatable element permitting its disposition in strand receiving position in respect to the supply and receiving reels, and locking means reactive on the oscillatable element manipulative into and

out of locking engagement with the oscillatable element in respect to either of a pair of the reels.

4. A tandem cable stranding mechanism comprising at least one pair of reels consisting of a strand pay-off and a strand build-up reel in axial rotational alignment on a main shaft member, a strand guiding device disposed between the pay-off and build-up reels rotatable with the main shaft member, said strand guiding device being oscillatable from a strand receiving position in respect to one of the reels of a pair to a similar position in respect to the other of said reels of the same pair, and locking means for securing the strand guiding device in both said positions.

5. A tandem cable stranding mechanism in accordance with claim 4 in which the oscillatable strand guiding device is dynamically balanced and incorporates a locking means comprising an oscillatable element manipulative into and out of locking engagement of the strand guiding device in its two positions of operation.

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