

Sept. 4, 1934.

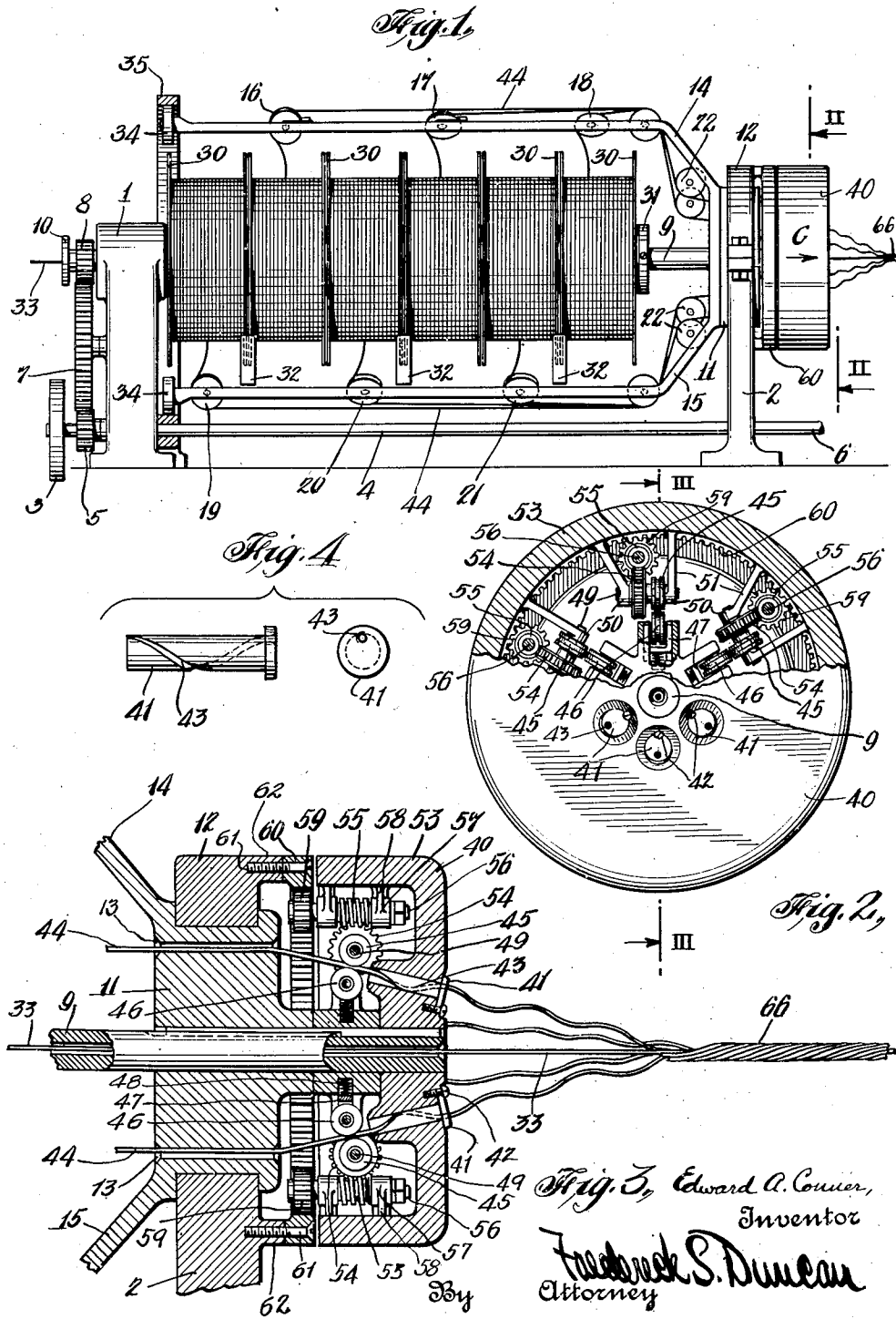
E. A. CONNER

1,972,290

STRANDING

Filed May 9, 1925

2 Sheets-Sheet 1



Sept. 4, 1934.

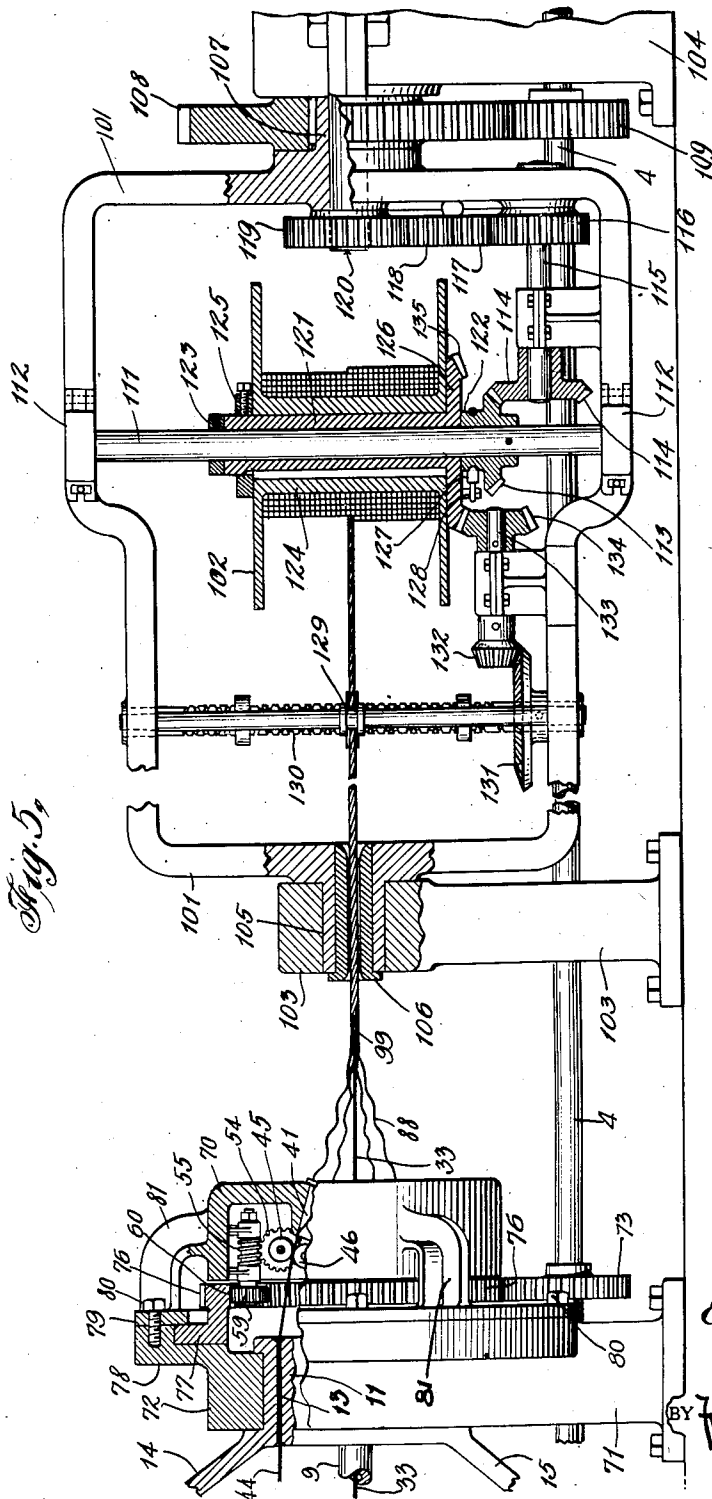
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

1,972,290

STRANDING

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Delaware

Application May 9, 1925, Serial No. 29,999

6 Claims. (Cl. 117—16)

This invention relates to wire stranding, by which is meant the formation of a plurality of wires into a strand, or the formation of a plurality of such strands into a wire rope, the expression "stranding" being herein used generically to designate either of the above operations, or the subsequent formation of a plurality of wire ropes into a cable, as it is not intended to use the expression "stranding" with any technical limitation to the formation of one or more layers of wires laid together with or without a core.

An important object of the invention is to provide an improved stranding process characterized by the step of driving each wire or other strand component individually through a die or equivalent means to effect the preformation of the several components into helices, and then laying these helical components together to form a wire strand, rope or cable so that in the completed product the helical components respectively are free from tendency to separate from each other when severed, such a product being designated as a dead lay strand, rope or cable, for the sake of brevity.

A further important object is to provide a stranding process thus characterized by the step of driving the components through means to effect their helical preformation, in order to avoid the possibility of undesirable deformation of the helices by their elongation when subjected to the tension that characterizes certain other processes which involve drawing wires through preforming dies, in contradistinction to the novel step of driving as herein disclosed.

Still another object is to provide a stranding machine to carry the improved stranding process into effect, and which is characterized by instrumentalities co-operating in a novel combination to drive the strand components through means to effect their helical preformation severally, and to lay these helical components together, thereby forming continuously the completed strand, rope or cable.

This desirable result is preferably accomplished by combining individual driving devices for the several component wires with the preforming dies, nozzles or other preforming devices, in a preforming head, and by combining this preforming head in a rotatable unitary structure with reels provided with supplies of component wires, so that the unit as a whole constitutes a rotor or compact rotatable structure constructed and arranged to lay these helical components together and thus produce a

dead lay wire strand, rope or cable which can be wound up on a suitable reel as a completed product.

Or, the preforming devices and means to drive the wires therethrough can be combined in a stationary preforming head to which the individual component wires may be led from stationary supply reels, and the laying of the helical components can be effected by means of a suitable rotating flyer and the completed product may be wound up on a reel as it is laid.

Accordingly, whether the head in which the preforming devices and driving means are combined be stationary or rotating, the result of driving the wire strand components through the preforming means, rather than drawing them therethrough, makes it possible to wind up the completed strand, rope or cable by much simpler means than when it is necessary to provide a winding appliance with suitable means for exerting a formative draft upon the strand, rope or cable while being laid and wound up concurrently, so that the improved process can be carried into effect by more compact apparatus, simpler to construct and operate, and therefore less expensive to provide and maintain, and the completed article can be produced with more expedition and at less cost than by the conventional drawing process.

Other objects of the invention will appear in the description of the apparatus and its mode of operation to carry into effect the improved driving process.

In the drawings,

Figure 1 is a view in side elevation of a machine adapted to form a strand or rope consisting of a core surrounded by six enveloping wires or strands, this particular number being selected merely because it conforms to conventional practice. It is to be understood, however, that the number of strands is by no means invariable, it being, of course, permissible to use any number of strand components, with or without a core, which can be properly utilized.

Fig. 2 is a view in vertical transverse section on the irregular line II—II of Fig. 1, the figure being taken on an enlarged scale.

Fig. 3 is a vertical longitudinal section on the line III—III of Fig. 2.

Fig. 4 is a detail view showing one of the preforming devices isolated, in side elevation and front elevation respectively.

Fig. 5 is a view in side elevation of a modified form of apparatus for carrying into effect a modified process.

Referring then to Fig. 1, support for the operating parts may consist of standards 1 and 2 mounted on any suitable foundation. Power may be imparted to the machine in any suitable manner through the medium of a gear 3 carried by the lay shaft 4 which extends from the region 6 preferably to actuate suitable take-up mechanism, not shown, for the completed product.

The lay shaft 4 carries a gear 5, with an idler gear 7 which transmits power to the gear 8 mounted on a spindle 9, which in turn is mounted in suitable bearings in the standards 1 and 2 and is formed with an axial bore. In order to permit sliding of the spindle through its bearings in the standards 1 and 2 for the purpose of removing depleted spools and replacing them with full spools, the gear 8 is made easily removable, being splined on the spindle 9 and locked thereon by a small hand wheel 10 which is screwed on to the end of the shaft. The journal which turns in the bearing in standard 1 is of conventional formation and requires no further description. The journal which turns in the bearing in standard 2, however, is preferably of a type particularly adapted for use in the machine, and for an understanding of it reference is made to Fig. 3, which shows the spindle 9 as provided with a collar 11 splined to the spindle and which turns in bearings formed in the standard 2 and bearing cap 12, and constitutes the head of the flyer or rotor, which will be further described in detail. The part 11 is provided with six bores 13, spaced at substantially equal angles with respect to the spindle, through which bores the wires are led from spools 30 to be formed into helices before being wrapped around the core 33 to constitute component parts of a completed strand as will be described more at length hereinafter.

The flyer for the unit consists of two arms 14 and 15 integrally or otherwise rigidly connected with the collar 11 and extending substantially parallel with the spindle 9 and diametrically opposite to each other. The arm 14 is provided with three swivel pulleys 16, 17, and 18 located respectively in such positions that they will be severally opposite alternative wire spools carried by the spindle 9. The arm 15 is likewise provided with three swivel pulleys 19, 20, and 21 (see Fig. 1) these, however, being so located that they occupy positions opposite the remaining three spools respectively. The advantage of this arrangement lies in the fact that by means of it approximately uniform distribution of the points of application of the tension on the wires is secured as the wires are drawn from the spools, and even balance of the flyer is secured. The pulleys 16, 17, and 18 and also the pulleys 19, 20, and 21 are swiveled in order that as the diameters of the coils of wire are reduced as the wire is drawn off the planes of these pulleys will be approximately tangential to the coils of wire and the wire will run evenly over them. After the wires are drawn over the aforesaid pulleys, their ends travel on the pulleys 22, and thence through the bores 13 of the collar 11. The wire supply spools indicated by the numeral 30 are rotatably carried on the spindle 9 and motion of them along the spindle 9 is prevented by a collar 31. Since the spools are rotatably mounted on the spindle 9, some sort of means is desirable for damping their free motion thereon and such means may consist of the brakes 32 carried by one of the arms, as for instance, arm 15. These brakes bear on the flanges of the spools, each brake preferably operating on two spools. For the purpose

of steadying the arms 14 and 15, their free ends may be provided with rollers 34 which travel on the annular track 35, this arrangement being desirable merely to prevent them from flying out or otherwise running irregularly when the machine is operated at the high speeds for which it is intended.

When it is necessary to renew the supply of wire, the hand wheel 10 may be unscrewed and the gear 8 removed. The spindle may then be partially withdrawn in the direction of the arrow C until it is sufficiently clear of the bearing in the standard 1 to permit the removal of the spools. The spools may then be removed and full ones substituted and the spindle restored to its original position for the resumption of the laying operation.

The mechanism thus far described corresponds generally to that illustrated in the patent of Edward A. Conner, No. 1,518,253, issued December 9, 1924, and is not claimed specifically herein, as the same does not form an essential feature of the present invention, but is shown as a convenient type of structure with which to combine the novel mechanism which I have devised to carry into effect my improved process of driving the component wires through preforming means, and which I will now describe as follows:

In the illustrated embodiment of the combined preforming means and wire-driving devices, I have shown a preforming head 40 splined upon the spindle 9 and provided with six nozzles or dies 41, secured in place by screws 42, and having peripheral channels 43 which serve to preform helically the wires 44, for which purpose the latter are driven therethrough by means of six couples or pairs of rolls each comprising a positively driven roll 45 and an idler roll 46, each idler being journaled in bearing blocks 47 pressed outwardly by springs 48 to maintain a uniform contact of the wire 44 with the driving or forcing roll 45 of the couple. Each driving roll 45 is fast on a shaft 49 journaled in bearings 50 formed in brackets 51 extending inwardly from a peripheral flange 53 of the head 40, and on each shaft 49 is fast a worm gear 54 meshing with a worm 55 on a shaft 56 journaled in bearings 57 in brackets 58 carried also by the flange 53.

Each shaft 56 carries also a spur gear 59 engaged with an internal ring gear 60, and upon relative rotation of the head 40 and gear 60 the gears 59 are rotated with their shafts 56, and worms 55, actuating the worm-gears 54 to drive the shafts 49 and rolls 45 to drive the wires 44 through the dies 41, from which they issue in proper convergent relation and with the proper helical preformation, to coil together and form a strand 66, each component of which preferably has a radially contractile set or tendency which constantly maintains the laid relation of the components, even when they are severed, and whether or not there is provided a core wire or strand, such as that shown at 33. This core wire or strand may be derived from any suitable source, such as a spool or reel frictionally controlled to keep the core taut.

In the case of the particular construction of Fig. 1, the completed strand, rope or cable 66, as it leaves the head 40, is taken up by a suitable drawing-off mechanism at a point beyond the unit, and which may be actuated by an extension of the lay shaft from the region 6, but which is not illustrated, as any conventional type of take-up mechanism may be used, it being only necessary that its speed be co-ordinate with the speed

of the flyer. Such a drawing-off mechanism is illustrated and described in Letters Patent to E. A. Conner, No. 1,513,583, granted on Oct. 28, 1924.

As already indicated, the preforming head 40 may, and preferably does, rotate as a unitary structure with the flyer or rotor carried by the spindle 9, and comprising also the reels 30, and accordingly I have shown the ring gear 60 in Figs. 1 to 3 as fastened by screws 61 and brackets 62 to the standard 2 and cap 12, so that it is fixed against rotation, and therefore the spur gears 59 travel in a planetary orbit therewithin upon rotation of the spindle 9.

It is equally within the purview of my invention, however, to effect helical preformation of the strand components by driving them through nozzles or dies in a stationary preforming head and laying these helical components to form a strand, rope or cable, by means of a suitable rotating flyer acting on the helical components as they emerge from the preforming head, the flyer being preferably provided with a reel on which the completed product is wound up as it is laid.

An arrangement suitable for carrying into effect this modified process is shown in Fig. 5, which shows a stationary preforming head 70 supported by a standard 71 which takes the place of the standard 2 shown in connection with the unit illustrated in Figs. 1 to 3.

The head 70 may be identical in every respect with the head 40, its interior structure corresponding in detail to that shown and described with reference to Fig. 3, the description of which accordingly need not be repeated. Under favorable conditions, the rotor shown in Fig. 1 may be utilized, with its spindle 9, reels 30 and associated parts, as a structure to supply wire strand components 44 and a core 33 to the preforming head 70 through the bores 13 of a member 11 like that of Fig. 3, but which is clamped tightly against rotation between the standard 71 and its cap 72. When used thus, the gears 5, 7 and 8 of Fig. 1 may be discontinued, and suitable gearing may be supplied, running from the lay shaft 4, and herein shown as comprising a driving gear 73 meshed with an external gear 76 formed on a ring within which is formed an internal gear 60, meshing with, and adapted to drive, the spur-gears 59 of the head 70, each of which is connected by a worm 55 and worm-gear 54 with one of the rolls 45 which serve to drive a strand component 44 through one of the preforming nozzles or dies 41, in the manner hereinbefore described.

Suitable bearings are provided for the rotatable ring gear 76, the structure of which may be adapted to the speed of rotation required, and the character of the work to be performed, a simple form of bearing being shown by way of illustration at 77, comprising a flange on the ring-gear fitted to a flange 78 on the standard 71 and its cap 72, the bearing being completed by a ring 79 secured in place by bolts 80. If desired, the ring 79 may be formed as a unitary structure with the head 70, being connected thereto by brackets 81, thus promoting the rigidity of the preforming head, which is supported centrally by the spindle 9, on which it is keyed preferably in the manner shown in Fig. 3. It is to be understood, of course, that while I have illustrated a ring gear for actuating the strand-driving rolls, any suitable arrangement of gearing may be provided for that purpose, nor is it essential that supply reels shall be mounted in co-axial relation upon a shaft or spindle, as this arrangement is shown merely by way of example.

Upon issuing from the nozzles 41 the helical strand components 88 are delivered convergently toward the axis 33, which designates, in the illustrated embodiment, the core of the completed strand 99, the latter comprising six helical strand components laid rotatively in continuous helical parallelism, with their coils radially contractile relatively to the core, being also contractile helically relatively to each other, thus constituting the completed strand, rope or cable a dead lay product.

The requisite rotation of the assembled helical components is desirably imparted continuously by a flyer 101 provided preferably with a reel 102 upon which the strand being formed is wound under a slight yielding tension, and the reel is adapted to be turned end-over-end, by the rotation of the flyer, around an axis coinciding with that of the core of the strand under formation, thereby laying the strand at the rate of one complete set of six convolutions for each rotation of the flyer, which rotation corresponds to the period occupied in driving through each of the nozzles or dies 41 the length of material required to form a complete helical convolution, the rotation of the ring-gear 76 and the rotation of the flyer 101 being timed and co-ordinated to insure the above result.

The specific form of flyer and reel illustrated is not a part of this invention, nor necessary to its successful performance, but may be described briefly as a convenient means for carrying the process into effect. It comprises a frame 101 journaled in standards 103 and 104, the journal 105 in the first-named standard preferably having an axial bushing 106 rotating with the flyer.

The frame 101 has a hub 107 with a gear 108 keyed thereto, and is journaled on a shaft 120 fixed in the standard 104, and the frame is rotated by the action of the lay shaft 4 through gearing 109. The reel 102 is mounted upon a shaft 111 which is carried by bearings 112 at opposite sides of the frame, and is rotated, at a speed proportional to the rotation of the frame, by means of a bevel gear 113 pinned to the shaft and meshing with a bevel gear 114 on a counter-shaft 115 that carries also a spur-gear 116 forming one of a train with gears 117, 118 and 119, the last being fast on the fixed shaft 120 carried by the standard 104 and about which rotate the gear 108 and frame 101, so that by the planetary action of gear 118 around gear 119 the train of gears is caused to rotate the shaft 111.

The shaft 111 carries a sleeve shaft 121 mounted loosely thereon between the hub 122 of bevel gear 113 and a collar 123 fast on the shaft 111, and upon this sleeve is splined the barrel 124 of the reel 102, being held in place removably by a collar 125 at one end, and at the other end by a flange 126 extending from the sleeve shaft 121, and which constitutes one member of a friction clutch comprising a strap 127 connected to a post 128 on the flange 126 and engaged with the hub 122, the latter serving as the actuating member of the friction clutch, to cause co-rotation of the reel 102 with the shaft 111.

The reel 102 is rotated end-over-end with the shaft 111 by rotation of the flyer 101, to lay the helical strand components in a strand, rope or cable, and the product thus laid is wound up on the reel 102 by the action of the friction clutch just described, which permits slippage of the reel as the diameter of the wound-on product increases.

Reference is herein made to my co-pending

divisional application Ser. No. 216,796, filed September 1, 1927 which contains claims drawn to the rotatable head and supply, so that the structure thereof is not claimed specifically herein.

A distributing device is illustrated at 129 working upon a shaft 130 which is connected by gears 131, 132, shaft 133 and gears 134 and 135 to the reel rotating mechanism and provides for laying the stranded product properly upon the reel.

Having thus described my invention, and with the knowledge that changes and modifications may be made that will nevertheless not depart from the spirit of the invention,

I claim:

1. In a stranding machine, a preforming head provided with a series of nozzles each adapted to form a strand component into a helix, said nozzles being arranged in convergent positions about the axis of said head to deliver the helical components for laying in co-axial relation to form a strand, rope or cable continuously along said axis, and means comprising a series of rolls in pairs, one pair for each strand component and each pair including a driving roll and an idler roll, said driving rolls being actuated by shafts journaled in bearings carried by said head and having worm-gears meshing with worms on shafts also mounted in bearings on said head, said worm-shafts being provided with gears meshing with a gear adapted to cause rotation of said worm-shaft gears, worms, worm-gears and driving rolls respectively, upon relative rotation of said gear and head, thereby to drive said strand components through their respective nozzles, means to support said gear in operative position engaged with said worm-shaft gears, and means to cause said relative rotation.

2. In a stranding machine, a preforming head provided with a series of nozzles each adapted to form a strand component into a helix, said nozzles being arranged in convergent positions about the axis of said head to deliver the helical components for laying in co-axial relation to form a strand, rope or cable progressively along said axis, and means to drive said helical components through said nozzles, said means comprising a series of rolls in pairs, one pair for each strand component and each pair including a driving roll and an idler roll, said driving rolls being actuated by shafts journaled in bearings carried by said head and having worm-gears meshing with worms on shafts also mounted in bearings on said head, said worm-shafts being provided with gears meshing with an internal ring-gear adapted to cause rotation of said worm-shaft gears, worms, worm-gears and driving rolls respectively, upon relative rotation of said ring-gear and head, thereby to drive said strand components through their respective nozzles, means to support said ring-gear in operative position engaged with said worm-shaft gears, and means to cause said relative rotation.

3. In a stranding machine, a preforming head provided with a series of nozzles each adapted to form a strand component into a helix, said nozzles being arranged in convergent positions about the axis of said head to deliver the helical components for laying in co-axial relation to form a strand, rope or cable along said axis, and means to drive said helical components through said nozzles, said means comprising a series of rolls in pairs, one pair

for each strand component and each pair including a driving roll and an idler roll, said driving rolls being actuated by shafts journaled in bearings carried by said head and having worm-gears meshing with worms on shafts also mounted in bearings on said head, said worm-shafts being provided with gears meshing with an internal ring-gear adapted to cause rotation of said worm-shaft gears, worms, worm-gears and driving rolls respectively, upon relative rotation of said ring-gear and head, thereby to drive said strand components through their respective nozzles, means to support said ring-gear in operative position engaged with said worm-shaft gears, and means to cause rotation of said ring-gear.

4. In a stranding machine, a preforming head provided with a series of nozzles each adapted to form a strand component into a helix, said nozzles being arranged in convergent positions about the axis of said head to deliver the helical components for laying in co-axial relation to form a strand, rope or cable continuously along said axis, and means to drive said helical components through said nozzles; and in combination with said preforming head a flyer to receive said helical components from said head, and means to rotate said flyer to cause rotation of the strand, rope or cable under formation, and thus to lay said helical components in assembled relation helically as they emerge from said preforming head.

5. In a stranding machine, a preforming head provided with a series of nozzles each adapted to form a strand component into a helix, said nozzles being arranged in convergent positions about the axis of said head to deliver the helical components for laying in co-axial relation to form a strand, rope or cable continuously along said axis, and means to drive said helical components through said nozzles; and in combination with said preforming head a flyer provided with a reel adapted to receive the strand, rope or cable as it is formed, and means to rotate said flyer and said reel respectively to wind up said strand, rope or cable under yielding tension, said reel being supported in position to turn end-over-end with said flyer as the flyer is rotated to cause rotation of the strand, rope or cable under formation, and thus to lay said helical components in assembled relation helically as they emerge from said preforming head.

6. In a stranding machine, a preforming head provided with a series of nozzles each adapted to form a strand component into a helix, said nozzles being arranged in convergent positions about the axis of said head to deliver the helical components for laying in co-axial relation to form a strand, rope or cable continuously along said axis, and means to drive said helical components through said nozzles, said means comprising a series of rolls in pairs, one pair for each strand component, and each pair including a driving roll and a spring-pressed idler roll, said driving rolls being actuated by shafts journaled in bearings carried by said head and having worm-gears meshing with worms on shafts also mounted in bearings on said head, said worm-shafts having axes parallel with the axis of the head and being provided with gears arranged in a circle about said axis, meshing with an internal ring-gear adapted to cause rotation of said worm-shaft gears, worms, worm-gears and driving rolls re-

spectively, upon relative rotation of said ring-gear and head, thereby to drive said strand components through their respective nozzles. means to support said ring-gear in operative position engaged with said worm-shaft gears, and means to cause rotation of said ring, comprising an external gear on said ring, and a lay-shaft geared to said external gear; and in combination with said preforming head and ring-gear a flyer also rotated by said lay shaft and provided with a reel adapted to receive the strand, rope or cable as it is formed, and means to rotate said reel to wind up said strand, rope or cable under yielding tension, said reel being supported in position to turn end-over-end with said flyer as the flyer is rotated, to cause rotation of the strand, rope or cable under formation, and thus to lay said helical components in assembled relation helically as they emerge from said preforming head.

EDWARD A. CONNER.

15	90
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25	100
30	105
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