Nov. 13, 1928. 1,691,337

E. A. CONNER

STRANDING MACHINE

Original Filed July 25, 1925 4 Sheets-Sheet 1

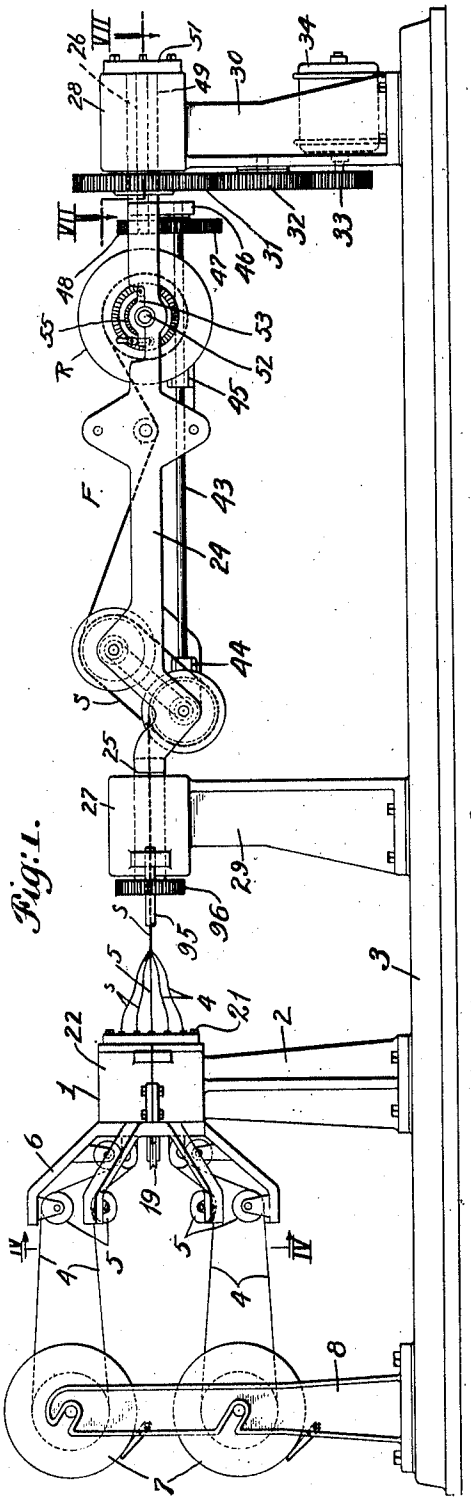


Fig. 1.

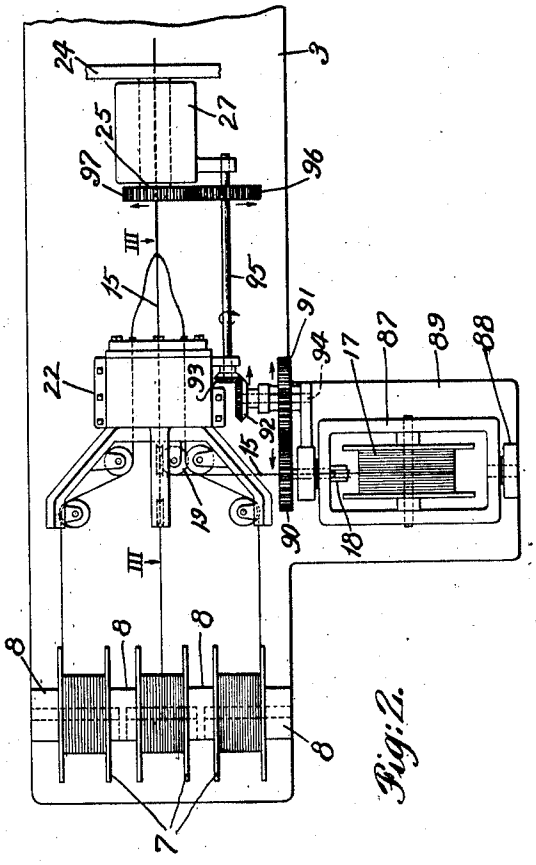


Fig. 2.

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STRANDING MACHINE

Original Filed July 25, 1925 4 Sheets-Sheet 2

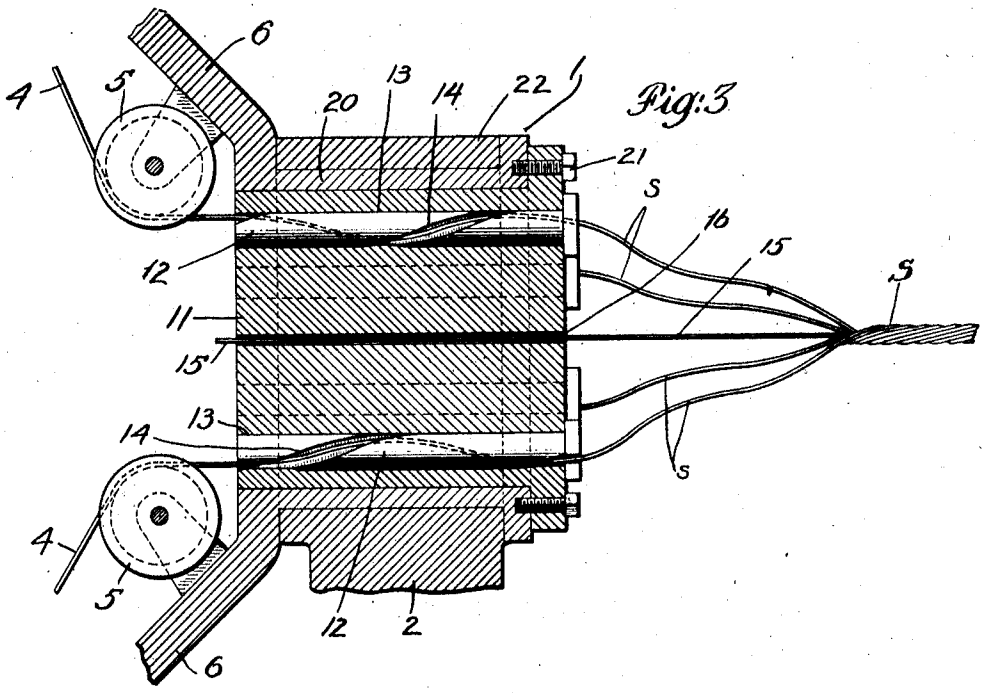


Fig:3

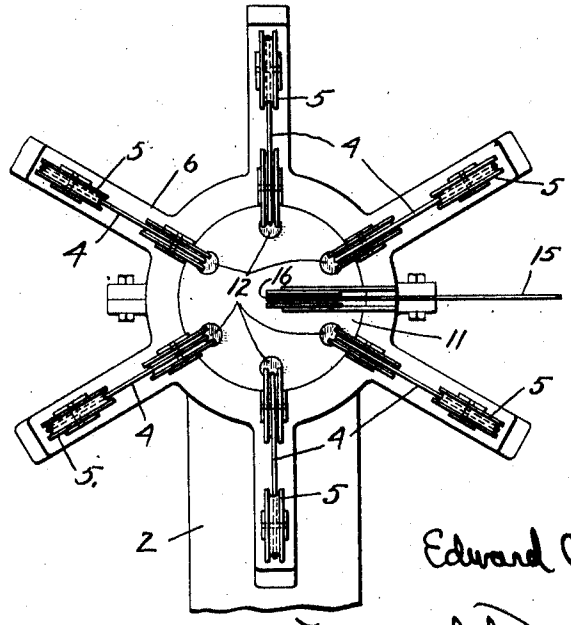


Fig:4.

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Nov. 13, 1928. 1,691,337

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STRANDING MACHINE

Original Filed July 25, 1925 4 Sheets-Sheet 3

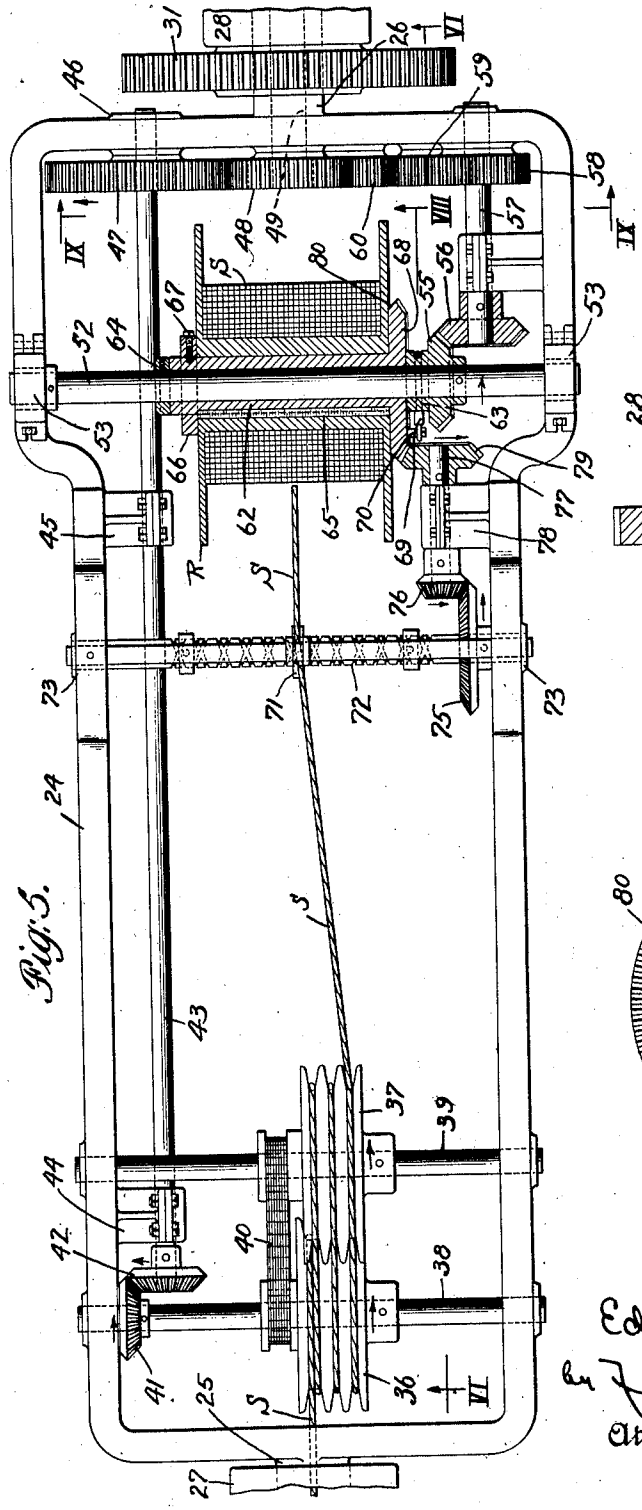


Fig. 5.

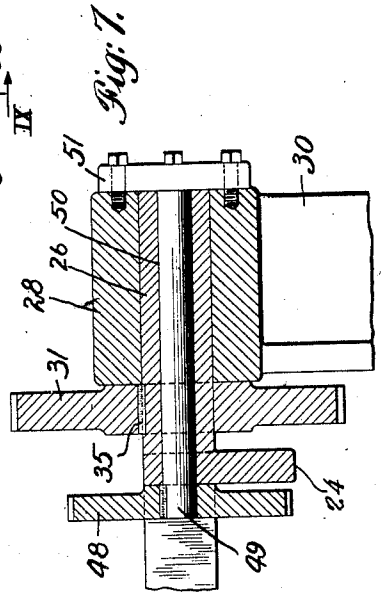


Fig. 7.

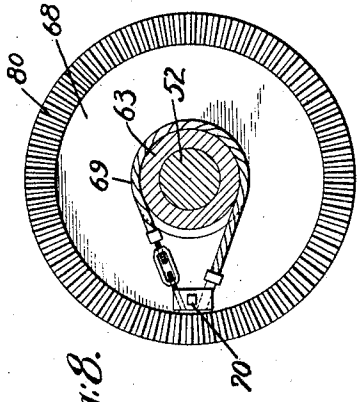


Fig. 8.

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Nov. 13, 1928. 1,691,337

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STRANDING MACHINE

Original Filed July 25, 1925 4 Sheets-Sheet 4

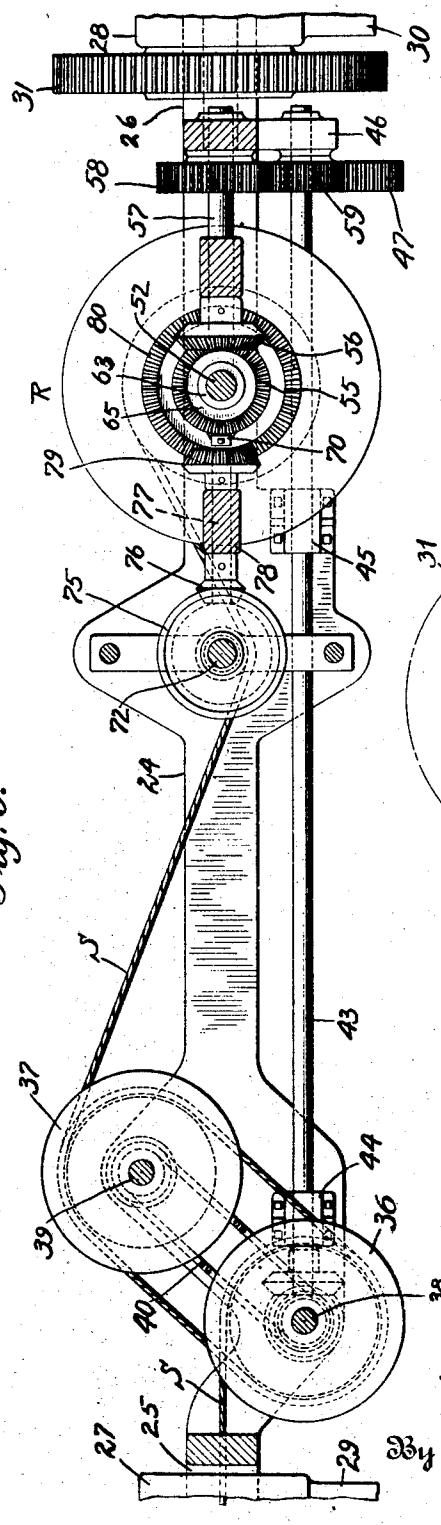


Fig. 6.

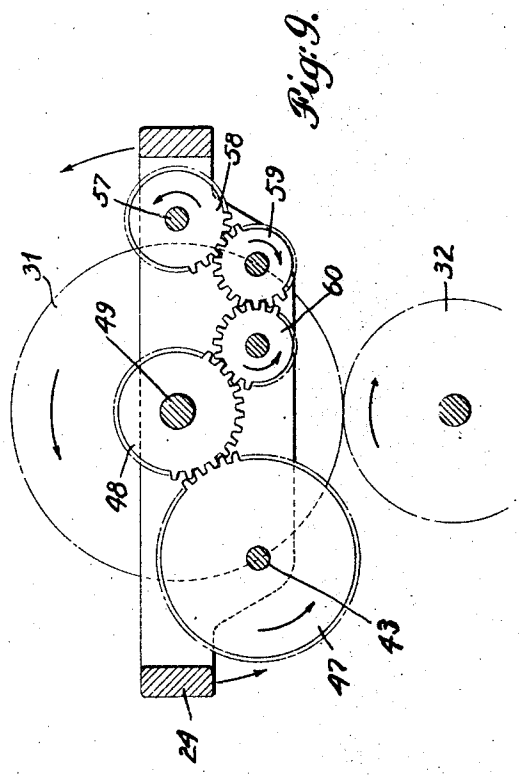


Fig. 9.

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By Frederick D. Wilson
Attorney

Patented Nov. 13, 1928. 1,691,337

UNITED STATES PATENT OFFICE.

EDWARD A. CONNER, OF STRATFORD, CONNECTICUT, ASSIGNOR TO AMERICAN CABLE COMPANY, INC., A CORPORATION OF DELAWARE.

STRANDING MACHINE.

Application filed July 25, 1925, Serial No. 45,970. Renewed January 21, 1928.

This invention relates to 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, so that it is not intended to use the expression stranding with any technical limitation to the formation of a single layer of wires laid together with or without a core.

An object of the present invention is to provide a stranding machine with a non-rotating head having means to lay the several component wires or strands in a strand, rope or cable, as the strand components are caused to pass through the head. Another object of the invention is to combine with the stationary head in such a machine means for conveniently holding a set of supply reels containing the individual wires used as stock for feeding the head, and for substituting rewound reels for the reels that become depleted. As the head is non-rotating, these reels need have no movement bodily around the stranding axis of the machine but rotate about individual axes in fixed position and may be spaced at distances from each other and from the stranding axis suitable to permit the provision of desirably large supplies of the strand components, thus permitting unusually long continuous operation of the machine without replenishment of the supplies, so that the product is free from splices and uniform in lay.

A further object of the invention is to provide a flyer rotating about the stranding axis, having means actuated positively to draw the strand components through the head and acting to deliver the completed product to a reel mounted to rotate bodily with the flyer and adapted to wind up the product under yielding tension.

The invention is of particular utility when embodied in a machine for carrying out the process forming the subject of, and described in, United States Patent No. 1,513,583, granted Oct. 28, 1924, said process being characterized by the fact that, prior to laying, the component wires or strands are formed into helices of suitable dimensions, so that when the finished product is severed, the component wires or strands are substantially free from tendency to separate, a strand, rope or cable of this character being sometimes designated as a "dead-lay" strand, rope or cable.

To this end, a further object of the invention is to provide a non-rotating head with preforming means comprising a set of nozzles or dies mounted on the head in spaced relation around the stranding axis and each adapted to act upon one of the strand component wires to form the same into a helix, the preforming nozzles delivering these helical components properly to lay them in a strand, rope or cable.

Other objects of the invention will appear in the description of the machine of the present application and its functions and mode of operation.

Describing the drawings,

Fig. 1 is a view in side elevation of a stranding machine embodying the invention.

Fig. 2 is a fragmentary view in plan of part of the above machine, showing also means for feeding a core thereto continuously.

Fig. 3 is a detail view on an enlarged scale, in vertical longitudinal section on the line III—III of Fig. 1.

Fig. 4 is a view in vertical section of the preforming unit, on an enlarged scale, taken on the line IV—IV of Fig. 1.

Fig. 5 is a fragmentary detail view in plan, on an enlarged scale, of the rotating flyer comprising the drawing means, winding-up reel and associated parts shown in Fig. 1, some of the parts being shown in section.

Fig. 6 is a view in vertical section on the irregular line VI—VI of Fig. 5.

Fig. 7 is a view in vertical section on the line VII—VII of Fig. 1.

Fig. 8 is a fragmentary detail view in vertical section, on an enlarged scale, taken on the line VIII of Fig. 5.

Fig. 9 is a fragmentary detail view of a diagrammatic character, in vertical section, taken on the line IX—IX of Fig. 5.

In the embodiment illustrated, the part designated by the reference character 1 is a preforming head, supported in non-rotating position upon a suitable standard 2 bolted to the base 3 of the machine, and to which the individual component wires or strands 4 are led over guide pulleys 5, supported by suitable brackets 6, from reels, or other suitable sources of supply 7 mounted rotatably in standards 8 bolted to the base.

In the form shown in Fig. 3, the preform-

ing head 1 comprises a member 11 having a series of six preforming devices 12 mounted in bores 13 of the part 11 and provided with helical grooves 14 through which the wires 4 are drawn simultaneously and consequently formed into helices *s* before being wrapped about the centrally disposed core 15 to constitute component parts of a complete strand. These devices, therefore, constitute six dies or nozzles spaced equally about the central bore 16 through which the core 15 is led from a suitable source of supply 17 (see Fig. 2) around guide pulleys 18 and 19, and preferably the member 11 is of integral formation, for the sake of compactness and strength, and is shown as embraced by a bushing 20 to which the member 11 is bolted at 21, this bushing being utilized as the support for the brackets 6 which carry the guide pulleys 5 for the wires 4. A cap is shown at 22 bolted to the standard 2, for the purpose of retaining the above described parts removably in assembled position.

When the strand components 4 have been acted upon by the preforming devices 12, they emerge in the helical form indicated at *s*, and are laid together around the core 15 to form a complete strand, wire or cable, such as that shown at S, which constitutes the completed product, and this product is preferably drawn off and wound up, for transportation and use, by suitable means, which may take any convenient form.

I have shown as the preferred means for the above purpose a flyer designated by the reference character F which in pursuance of my invention comprises a frame 24 having hollow trunnions 25 and 26 journalled in suitable bearings 27 and 28 carried by standards 29 and 30 bolted to the base 3, provision being made for rotation of the flyer by suitable means shown as gears 31, 32, and 33, the last gear mentioned being mounted upon the shaft of an electric motor 34. The gear 31 is splined at 35 upon the hollow trunnion or shaft 26, as shown in Fig. 7.

As the completed product S passes from the preforming head 1, it is drawn through the hollow trunnion 25 by a series of grooved pulleys 36 and 37 mounted on transverse shafts 38 and 39 supported rotatably in the frame 24 and connected for co-rotation by a link belt or driving chain 40, which insures positively co-rotation of the pulleys 36 and 37 at the same speed, and the shaft 38 is driven positively by means of bevel gears 41 and 42, the latter being fast upon a shaft 43 carried lengthwise of the frame 24 in bearing brackets 44 and 45, having its other end mounted rotatably in suitable bearings 46 at the opposite end of the frame, where the shaft is provided with a gear 47 which meshes with a gear 48 fast upon a shaft 49 which extends through the central bore 50 of the hollow trunnion 26, and is secured in fixed position by a flange 51 bolted to the bearing 28 of the standard 30. When the frame 24 is rotating, the gear 47 tracks upon the gear 48 and is caused to rotate, with the result that the shaft 43 is run at proportionate speed and drives the pulleys 36 and 37 positively for drawing-off the completed product S, and thus for drawing the strand components 4 through the preforming devices 12.

The product S, in pursuance of my invention, is wound upon a reel R under a yielding tension, and this reel is adapted to be turned end-over-end by the rotation of the flyer 24, around an axis coinciding with that of the strand under formation, which may be termed the stranding axis, for the sake of brevity, thereby laying the strand at the rate of one complete set of convolutions for each rotation of the flyer, which rotation corresponds to the period occupied in drawing through each of the preforming devices 12 the length of material required to form a complete helical convolution, the rotation of the flyer 24 and of the reel R being timed and coordinated to insure the above result.

To accomplish this rotation and end-over-end turning of the reel R properly, the reel is shown as mounted upon a shaft 52 which is carried removably in bearings 53 on opposite sides of the frame 24, and the reel is rotated, at a speed proportional to the rotation of the frame, by means of a bevel gear 55 pinned to the shaft and meshing with a bevel gear 56 on a counter shaft 57 that carries also a spur gear 58 forming one of a train with gears 59 and 60, the latter meshing with the stationary gear 48 upon the fixed shaft 49, which as already described is the one upon which the planetary gear 47 runs to drive the shaft 43, so that proportional rotation of the reel R is thus insured.

The shaft 52 carries a sleeve shaft 62 mounted loosely thereon between the hub 63 of the bevel gear 55 and a collar 64 fast upon the shaft 52, and upon this sleeve is splined the barrel 65 of the reel R, being held in place removably by a collar 66 at one end, secured thereto by a set screw 67, and at the other end by a flange 68, extending from the sleeve shaft 62. This flange 68 constitutes one member of a friction clutch which comprises also a strap 69 connected to a post 70 on the flange 68 and engaged with the hub 63, the latter serving as the actuating member of the friction clutch, to cause co-rotation of the reel R with the shaft 52. The reel is thus rotated end-over-end with the shaft 52 by rotation of the flyer 24, to lay the helical strand components in a strand, rope or cable, and the product thus laid is wound-up on the reel R by the action of the friction clutch just described, which permits slippage of the reel as the diameter of the wound-up product S increases.

A suitable distributing device may be pro-

vided as indicated at 71, which may be of the conventional character shown, mounted upon a distributing shaft 72 journalled at 73 in bearings carried by the frame 24, and the actuation of which is provided for by bevel gears 75 and 76, the latter being mounted upon the counter-shaft 77 carried in bearings 78 upon the frame 24, and having a bevel gear 79 engaged with teeth 80 upon the periphery of the flange 68, so that the distributing device is driven at a speed proportionate with the speed of the reel R.

The supply reel 17 for the core is preferably rotated bodily in a frame 87 journalled in suitable bearings 88 mounted on an extension 89 of the base 3, and this frame may desirably be rotated at suitable speed by gears 90, 91, 92, and 93, with connecting shafts 94 and 95 actuated by gears 96 and 97 of which the latter is fast on the trunnion 25 of the flyer frame 24.

Having described my invention, I claim:

1. In a stranding machine, a non-rotating head provided with means to form the strand components into helices prior to laying said strand components, and means to draw said strand components through said preforming means and lay the helical components and at the same time rotate the product at a speed coordinate with the speed of formation of the helices.

2. In a stranding machine, a non-rotating head provided with a plurality of preforming nozzles adapted to form into helices strand components passing through said nozzles prior to laying said strand components, and means to draw said strand components through said preforming nozzles and lay the helical components and at the same time rotate the product at a speed coordinate with the speed of formation of the helices.

3. In a stranding machine, a non-rotating head provided with a plurality of preforming nozzles arranged about the stranding axis, said preforming nozzles being adapted to form into helices strand components passing therethrough.

4. In a stranding machine, a non-rotating head provided with means for individual helical preformation of the several strand components prior to laying the same, and means to lay said helical components in a strand, rope or cable and rotate the completed product on its axis relatively to said head.

5. In a stranding machine, a non-rotating head provided with means to form the strand components into helices prior to laying said strand components, a support for a plurality of reels containing individual supplies of said strand components; and means to draw said strand components through said preforming means and lay the helical components and at the same time rotate the product at a speed coordinate with the speed of formation of the helices.

6. In a stranding machine, a non-rotating head provided with means to form the strand components into helices prior to laying said strand components, a non-rotating support for a plurality of reels containing individual supplies of said strand components; and means to draw said strand components through said preforming means and lay the helical components and at the same time rotate the product at a speed coordinate with the speed of formation of the helices.

7. In a stranding machine, a non-rotating head provided with means to lay the strand components in helical relation; a support for a plurality of reels containing the individual supplies of said strand components; and a flyer mounted to rotate relatively to said support and head, exerting formative traction upon said several strand components, drawing them simultaneously through the laying head.

8. In a stranding machine, a non-rotating head provided with means for individual helical preformation of the several strand components prior to laying said strand components, and a flyer provided with means to wind up the finished product, rotating the same about its axis.

9. In a stranding machine, a non-rotating head provided with means for individual helical preformation of the several strand components prior to laying said strand components, and a flyer provided with means to wind up the finished product, rotating the same about its axis, and a series of reels to contain individual supplies of said strand components, one of said reels being adapted to contain a supply of core material and having means to rotate said core at a speed co-ordinate with the speed of rotation of said flyer.

10. In a stranding machine, a head provided with means for individual helical preformation of the several strand components prior to laying them; a rotatable flyer having a reel mounted to rotate about an axis transversely disposed upon said flyer, and sharing also the body rotation of said flyer with said product about the stranding axis; and means to cause said several rotative movements of said flyer and reel respectively, whereby said flyer exerts a formative traction upon said strand components, drawing them respectively through said preforming means from individual sources of supply and winding said product on said reel.

11. In a stranding machine, a head provided with means for individual helical preformation of the several strand components prior to laying them; a rotatable flyer having a reel mounted to rotate about an axis transversely disposed upon said flyer, and sharing also the body rotation of said flyer with said product about the stranding axis; and means to cause said several rotative

movements of said flyer and reel respectively, whereby said flyer exerts a formative traction upon said strand components, drawing them respectively through said preforming means from individual sources of supply and winding said product on said reel without rotation of said product relatively to said reel.

12. In a stranding machine, a head provided with means for individual helical preformation of the several stranding components preparatory to laying said stranding components; a flyer having a reel mounted to rotate about an axis transversely disposed upon said flyer, and sharing also the body rotation of said flyer, and means to cause said several rotative movements of said flyer and reel respectively, said flyer being also provided with devices actuated positively to exert a constant formative traction upon said strand components and to deliver the completed product to said reel.

13. In a stranding machine, a head provided with means for helical preformation of the strand components preparatory to laying the same; a flyer having a reel mounted to rotate about an axis transversely disposed upon said flyer, and sharing also the body rotation of said flyer, and means to cause said several rotative movements of said flyer and reel respectively, whereby said flyer exerts a formative traction upon said strand components, drawing them respectively through said preforming means from individual sources of supply and winding said strand on said reel without rotation of said strand relatively to said reel, said flyer being also provided with auxiliary devices actuated positively to exert a constant formative tension upon said product and to deliver it to said reel, and being provided also with means to lay said product in regular convolutions upon said reel, said means for rotating said reel upon its proper axis comprising a device to conform the speed of such rotation with the increasing diameter of said convolutions, by permitting slippage of the reel.

14. In a stranding machine, a head provided with means for helical preformation of the stranding components, preparatory to laying the same; a flyer journalled in a suitable support, said flyer having a reel mounted to rotate about an axis transversely disposed upon said flyer, and sharing also the body rotation of said flyer, and means to cause said several rotative movements of said flyer and reel respectively, comprising a gear on said flyer, a fixed gear mounted co-axially with said flyer upon the support therefor, a gear rotatable co-axially with said reel, and connected frictionally with said reel, and gearing connecting said reel-actuating gear with said fixed gear, whereby said reel is rotated at a speed proportionate to that of said flyer, and at the same time is permitted to slip and compensate for the increased diameter of the product laid thereon; said flyer being also provided with devices actuated positively to exert a constant formative traction upon said cable and to deliver it to said reel.

15. In a stranding machine, a head provided with means for helical preformation of the stranding components preparatory to laying the same; a flyer journalled in a suitable support, said flyer having a reel mounted to rotate about an axis transversely disposed upon said flyer, and sharing also the body rotation of said flyer, and means to cause said several rotative movements of said flyer and reel respectively, said means comprising a gear on said flyer, in mesh with a fixed gear mounted co-axially with said flyer upon the support therefor, a gear rotatable co-axially with said reel, and connected frictionally with said reel, and gearing connecting said reel-actuating gear with said fixed gear, whereby said reel is rotated at a speed proportionate to that of said flyer, and at the same time is permitted to slip and compensate for the increased diameter of the product laid thereon; said flyer being also provided with a set of grooved pulleys connected together and geared to said fixed gear whereby said pulleys are actuated positively to exert a constant formative traction upon said cable and to deliver it to said reel.

16. In a stranding machine, a head provided with means for helical preformation of the strand components preparatory to laying, a support, and a flyer mounted on said support rotatively with relation to said head and adapted to draw said strand components through said head as the same are laid in a strand, rope or cable, said flyer having devices actuated positively to exert said formative traction upon said product, and means acting to wind said product up under yielding tension.

17. In a stranding machine, a stationary head provided with means for helical preformation of the strand components preparatory to laying, a support, and a flyer mounted on said support rotatively with relation to said head and provided with means acting to wind said product up under yielding tension.

18. In a stranding machine, a rotatable flyer having a reel mounted to rotate about an axis transversely disposed upon said flyer, and sharing also the body rotation of said flyer, said flyer being also provided with auxiliary devices actuated positively to exert a constant formative tension upon the stranded product and to deliver it to said reel, and being provided also with means to lay said product in regular convolutions upon said reel, said means for rotating said reel upon its proper axis comprising a de-

vice to conform the speed of such rotation with the increasing diameter of said convolutions, by permitting slippage of the reel.

19. A machine of the class described comprising, in combination, a base member, means thereon for spiralling and rotating a group of strands, a die for assembling the strands for movement in a common path, rotary devices for pulling the strands through the die and subsequently tensioning them arranged to revolve about the axis thereof, means for revolving the devices at the speed of rotation of the strands, means for rotating the devices, and a rotary wind-up reel arranged to revolve with the said devices.

20. A machine of the class described comprising, a base, means thereon for spiralling and rotating a group of wire strands, a die for assembling the strands to move in a common path, rotary devices for pulling the strands through the die and subsequently tensioning them arranged to revolve about the axis thereof, a wind-up reel also revoluble about the axis of the die, and means for revolving the devices and the reel at substantially the speed of rotation of the strands.

21. A machine of the class described comprising, a base, means thereon for spiralling and rotating a group of wire strands, a die for assembling the strands to move in a common path, rotary devices for pulling the strands through the die and subsequently tensioning them arranged to revolve about the axis thereof, a wind-up reel also revoluble about the axis of the die, means for revolving the devices and the reel at substantially the speed of rotation of the strands, and means for actuating the rotary devices.

22. The combination of a plurality of supply reels for wire, a device for simultaneously forming the wires into spirals and rotating such wires on their longitudinal axes, and means for bringing the spiralled and rotating wires together to form a cable.

23. A process of manufacturing cable from a plurality of straight wires, comprising spiralling and simultaneously rotating the wires on their longitudinal axes, and bringing the rotating wires together so that the spirals will intertwine to form the cable.

24. A process of manufacturing cable from a plurality of wires, comprising spiralling and simultaneously rotating the wires on their longitudinal axes, bringing the rotating wires together so that the spirals will intertwine, and stretching the wires to cause the spirals to hug each other closely in cable form.

In testimony whereof, I have signed this specification.

EDWARD A. CONNER.