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METHOD AND APPARATUS FOR TREATING WIRE ROPE

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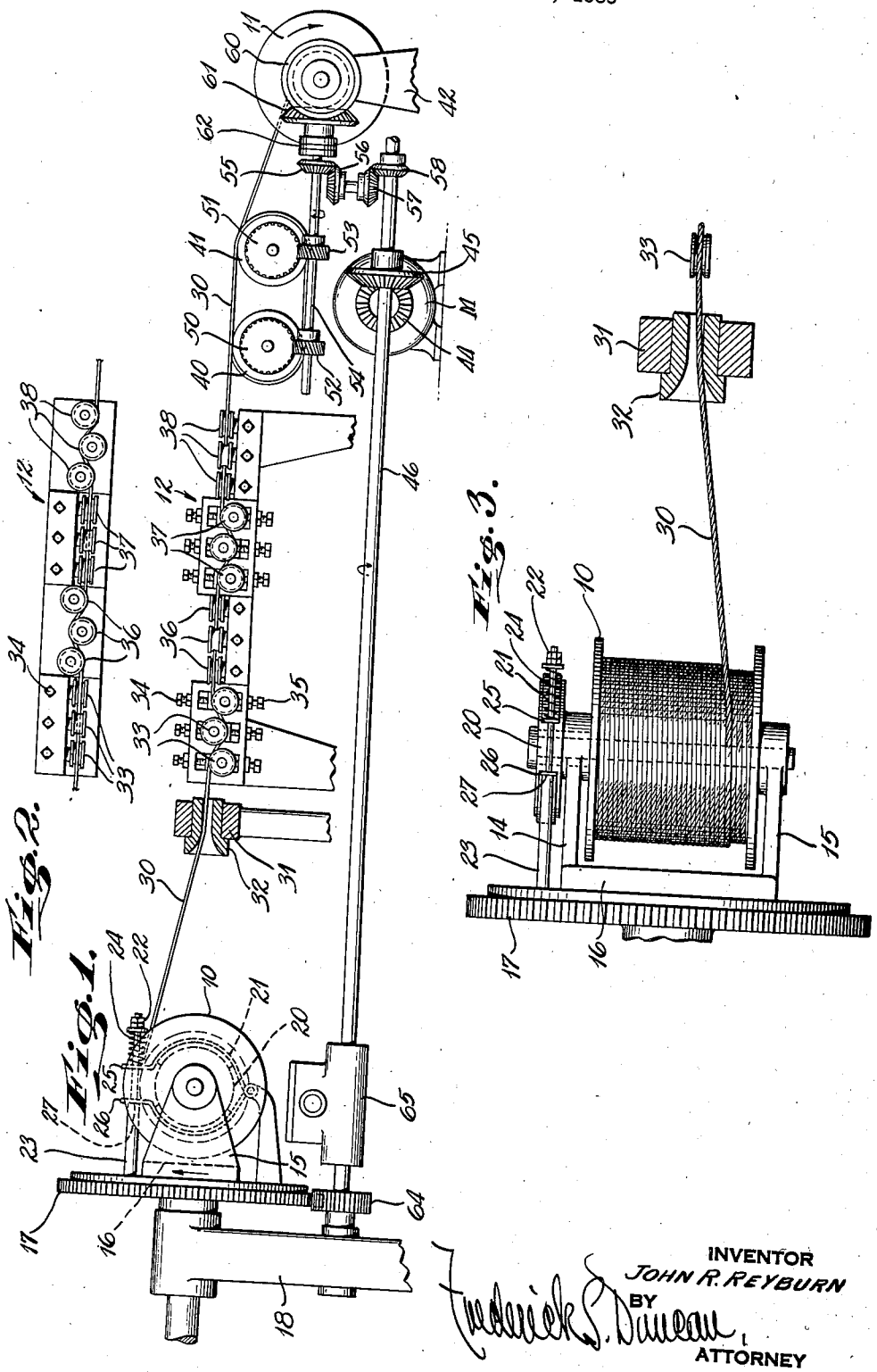


Fig. 1.

Fig. 2.

Fig. 3.

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METHOD AND APPARATUS FOR TREATING WIRE ROPE

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16 Claims. (Cl. 57—34)

This invention relates to a method and means for treating wire rope.

Various ropes as they come off the rope making machine possess residual torsional and bending stresses due to the method employed. Devices have been provided for removing these stresses from regular lay ropes by drawing the rope through offset rolls, sufficiently offset to subject component wires to a bending stress, which, coupled with a tensile stress from drawing the wires through the rolls, exceeds the elastic limit. This is done to give the component wires a permanent set, tending to make them lie inert in the rope.

In order to approach inertness, it was necessary to use rolls of comparatively small diameter and give these small diameter rolls a sufficient offset. As a result individual wires, individual strands, the core and the rope as a whole are distorted, bruised, and weakened.

It is an object of my invention to produce an inert rope while using rolls of larger diameter and with smaller offset, and this I accomplish by setting up other stresses which combine with the usual bending and tensile stresses to exceed the elastic limit of the component wires and because of the lesser offset, the power needed to draw the rope through the straightening rolls is reduced, and correspondingly the resulting tensile stress. I obtain the balance of the stress necessary to exceed the elastic limit by the torsional stresses from twisting the rope and the additional tensile stresses which result from winding the individual strands tightly upon the core. In the old method the elastic limit is exceeded by a combination of bending stresses produced by the straightening rolls and the tensile stresses resulting from drawing the wires through the rolls. In my method the total or ultimate stress results from four actions, the two just enumerated and the torsional stresses from twisting the rope, and the additional tensile stresses from winding the individual strands together tightly upon the core.

Other objects of the invention will appear from the following description taken in connection with the drawing in which,

Fig. 1 is a side view of a machine for treating wire rope in accordance with the principles of my invention;

Fig. 2 is a top plan view of the straightening section of the apparatus; and

Fig. 3 is a top plan view of the supply reel and associated rope twisting mechanism.

My method consists in twisting the rope as it is being operated on by straightening devices which bend the rope back and forth in angularly related planes but to less extent than in accordance with known methods.

In the drawing I have illustrated one form of apparatus which may be employed to carry out the method of my invention. The various elements of the apparatus may be supported on standards or brackets, some of which are indicated, on a frame or bed, not disclosed. The apparatus includes a supply reel 10 and a wind-up reel 11 and a set of straightening rolls generally indicated at 12. The supply reel 10 is mounted for rotation in arms 14 and 15 of a bracket 16 secured to a gear wheel 17 mounted on a shaft journaled in a bracket 18 supported on the frame of the apparatus. Mounted on the shaft of the supply reel 10 is a brake disk 20 with which cooperates a brake band 21, the braking pressure of which may be adjusted by means of a nut 22 on a rod 23 supported in bracket 16 which compresses a spring 24 against a flange 25 on one end of the brake band, the other end 26 of which is restrained against movement when such pressure is applied by an enlarged portion or shoulder 27 or equivalent means on the rod 23. By means of this construction the rope is held taut and its tension controlled as it enters the straightening rolls, as well as the amount of pull on the end of the rope 30 necessary to unreel the rope for a given off-set relation of the straightening rolls.

Mounted on a standard 31 on the frame of the apparatus is a guide 32 which guides the rope into the path of the first set of rolls 33 of the straightening mechanism. The axes of these rolls are offset as disclosed and the amount of offset, which is much less than in prior constructions, may be adjusted by means of set screws 34 and 35 in a well known manner. The straightening mechanism may include a second set of rolls 36 whose axes are arranged at right angles to the axes of the rolls 33, a third set of rolls 37 whose axes are in the same plane as the axes of the rolls 33 and a fourth set of rolls 38 whose axes are in the same plane as the axes of the rolls 36. These rolls may be adjusted into offset relation as required. Other forms of straightening mechanism may be employed.

The apparatus also includes a pair of draw-off drums 40 and 41 over which the rope 30 may be passed as indicated in Fig. 1, that is, the rope may pass around the forward side of the drum 41 and then around the rear side of the drum 40 and then again around the forward side of the

drum 41 and around the rear side of the drum 40 and then to the wind-up reel 11 which is mounted on a bracket 42 projecting from and supported on the frame of the apparatus. Other equivalent means may be employed to pull the rope through the straightening mechanism.

For the purpose of rotating the draw-off drums to draw the rope 30 off from the supply reel 10, any suitable driving mechanism may be employed. As illustrated a motor M may be mounted on the frame of the apparatus and its shaft may be provided with any suitable gear 44 meshing with a gear 45 on a main drive shaft 46 which may be suitably supported in brackets on the frame of the apparatus. The draw-off drums 40 and 41 may be equipped with spiral gears 50 and 51 with which mesh spiral gears 52 and 53 on a shaft 54 to which is secured a gear 55 meshing with a gear 56 mounted on a shaft on which is mounted a gear 57 which meshes with a gear 58 on the main drive shaft 46. By means of this construction the draw-off drums are driven directly by the motor M. The shaft 54 and the draw-off drum shafts are journaled in brackets not disclosed.

In order to drive the take-up reel 11 at sufficient peripheral speed at the beginning of the winding operation, the reel shaft is equipped with a gear 60 in mesh with a gear 61 of the proper ratio and driven from the shaft 54 and in order that that take-up reel may be driven at a slower speed as the reel is filled up, I provide between the gear 61 and the shaft 54 a friction slip clutch driving mechanism 62 of any approved construction.

In accordance with my method, I twist the rope 30 tightly as it enters the straightening rolls. This twisting is effected by rotating the supply reel 10 which for this purpose is mounted on the gear wheel 17 before referred to so that when the gear wheel is rotated in the direction indicated the supply reel will be rotated and the rope will be twisted. Driven from the shaft 46 and in mesh with the gear wheel 17 is a gear 64 mounted on a shaft supported in the bracket 18. This gear 64 is driven from the shaft 46 and in order that the speed of rotation of the gear wheel 17 may be controlled with respect to the speed of rotation of the shaft 46, I interpose a gear shift mechanism between the shaft 46 and the shaft which supports the gear wheel 64, and I preferably employ any well known type of fluid drive 65 which is preferably of a type which permits the speed of the gear wheel 17 to be adjusted in any desired manner with respect to the speed of the main drive shaft 46 and which may also provide a slip drive between the shaft 46 and the gear 17. By means of this construction I may speed up the rotation of the gear 17 and the supply reel in the plane of its axis at the beginning of an operation to cut down the wastage in rope and I may adjust the speed so as to obtain the required amount of twisting of the rope 30 depending upon the characteristics of the rope to be treated.

It will now be understood that in accordance with my method and as the method is carried out on an apparatus of the character disclosed, I do not depend solely upon the combination of the bending stresses produced in the straightening mechanism and the tensile stresses produced in pulling the rope through the straightening mechanism. I am, therefore, able to use rolls of larger diameter and offset them less than in prior constructions, and as a result individual wires, individual strands, the core and the rope as a whole, are not distorted, bruised, and weakened by excessive tensile and bending stresses. By producing the additional stresses necessary to stress the rope beyond its elastic limit by means which twists the rope, the straightening rolls will bend the component wires of the rope uniformly and to less extent and without spreading the wires. As the rope is twisted tightly and is pulled through the straightening rolls under less tension than heretofore possible, the rope will retain more nearly its original cross sectional shape as it passes through and leaves the straightening rolls and the component wires of the rope will have been treated uniformly and without injury and will occupy their proper position in relation to each other in the rope free from residual stresses. The relative values of the torsion due to twisting the rope and the additional tensile stress resulting from winding the individual strands tightly upon the core, the pull tension due to drawing the rope through the straightening mechanism, and the tension and compression due to the operation of the straightening mechanism on the rope can be adjusted as required to produce the best results in ropes of different characteristics and material.

A rope treated in accordance with my method and in an apparatus of the character disclosed will be tightly twisted and substantially inert, and the condition of the elements of the rope will be substantially uniform and equally balanced.

While I have described my improved method and a preferred apparatus for carrying out my method, it is to be understood that I reserve the right to all such changes in the method and apparatus disclosed as fall within the principles of my invention and the scope of the appended claims.

I claim:

1. The method of producing an inert rope which consists in simultaneously subjecting a section of the rope to twist torsion and bending stresses of insufficient values singly but of sufficient combined values to stress the elements of the rope beyond their elastic limit.

2. The method of treating a rope or the like which consists in rotating the rope to effect overtwisting and in bending the rope transversely in opposite directions when the rope is in such condition.

3. The method of producing an inert rope which consists in simultaneously subjecting a section of the rope to twist torsion, bending stresses and pull tension of sufficient combined values to stress the elements of the rope beyond their elastic limit.

4. The method of producing an inert rope provided with a core, which consists in simultaneously subjecting a section of the rope to bending stresses, pull stresses and torsion stresses and tensile stresses resulting from winding the individual strands together tightly upon the core, combining in value to exceed the elastic limit of the elements of the rope.

5. In an apparatus for treating rope or the like, the combination of a means for over-twisting the rope and means for straightening said overtwisted rope.

6. In an apparatus for producing an inert rope, the combination of supply reel, straightening mechanism, and pull-off means arranged in the order stated, means for operating said pull-off

means to draw the rope off from the reel and through the straightening mechanism, and means supporting said supply reel for rotation about an axis normal to its axis to twist the rope.

7. In an apparatus for producing an inert rope, the combination of supply reel, straightening mechanism and pull-off means arranged in the order stated, means for operating said pull-off means to draw the rope off from the reel and through the straightening mechanism, means supporting said supply reel for rotation about an axis normal to its axis to twist the rope, and means for rotating said supply reel about an axis normal to its axis at different speeds with respect to the pull-off speed of the rope.

8. In an apparatus for producing an inert rope, the combination of supply reel, straightening mechanism and pull-off means arranged in the order stated, means supporting said supply reel for rotation about an axis normal to its axis to twist the rope, and means for operating said pull-off means at a constant speed and rotating said supply reel about said axis at different speeds.

9. The combination of a series of off-set rope straightening rolls off-set to less extent than necessary to bend a rope of normal twist beyond its elastic limit, means for overtwisting the rope as it enters the straightening rolls and means for drawing the rope through the straightening rolls.

10. The combination of a series of off-set rope straightening rolls off-set to less extent than necessary to bend a rope of normal twist beyond its elastic limit, means for overtwisting the rope as it enters the straightening rolls, means for drawing the rope through the straightening rolls, and means for adjusting the off-setting of the rolls and controlling the amount of overtwist produced by said overtwisting means.

11. The combination of a series of off-set rope straightening rolls off-set to less extent than necessary to bend a rope of normal twist beyond its elastic limit, means for overtwisting the rope as it enters the straightening rolls, means for drawing the rope through the straightening rolls, and means for adjusting the relation of rate of feed of rope and amount of overtwisting.

12. The combination of a series of off-set rope straightening rolls off-set to less extent than necessary to bend a rope of normal twist beyond its elastic limit, means for overtwisting the rope as it enters the straightening rolls, means for drawing the rope through the straightening rolls, and means for controlling the pull tension on the rope comprising means applying a braking action on the rope before it enters said straightening rolls.

13. The combination of a series of off-set rope straightening rolls, means for drawing the rope through the straightening rolls, and means for controlling the pull tension of the rope comprising means for applying a braking action on the rope on the entrance side of the straightening rolls.

14. The combination of a supply reel and a straightening mechanism mounted for relative rotation about the axis of the rope to twist the portion of the rope between the supply reel and straightening mechanism.

15. The combination of a supply reel and a straightening mechanism mounted for relative rotation about the axis of the rope to twist the portion of the rope between the supply reel and straightening mechanism, and means for controlling the pull tension in said portion of the rope.

16. In an apparatus for treating rope or the like, the combination of means for overtwisting the rope, means for controlling the amount of overtwist of the rope, and means for straightening said overtwisted rope.

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