May 19, 1964 R. L. ZWOLINSKI ETAL 3,133,402

STRANDER

Filed April 12, 1962 2 Sheets-Sheet 1

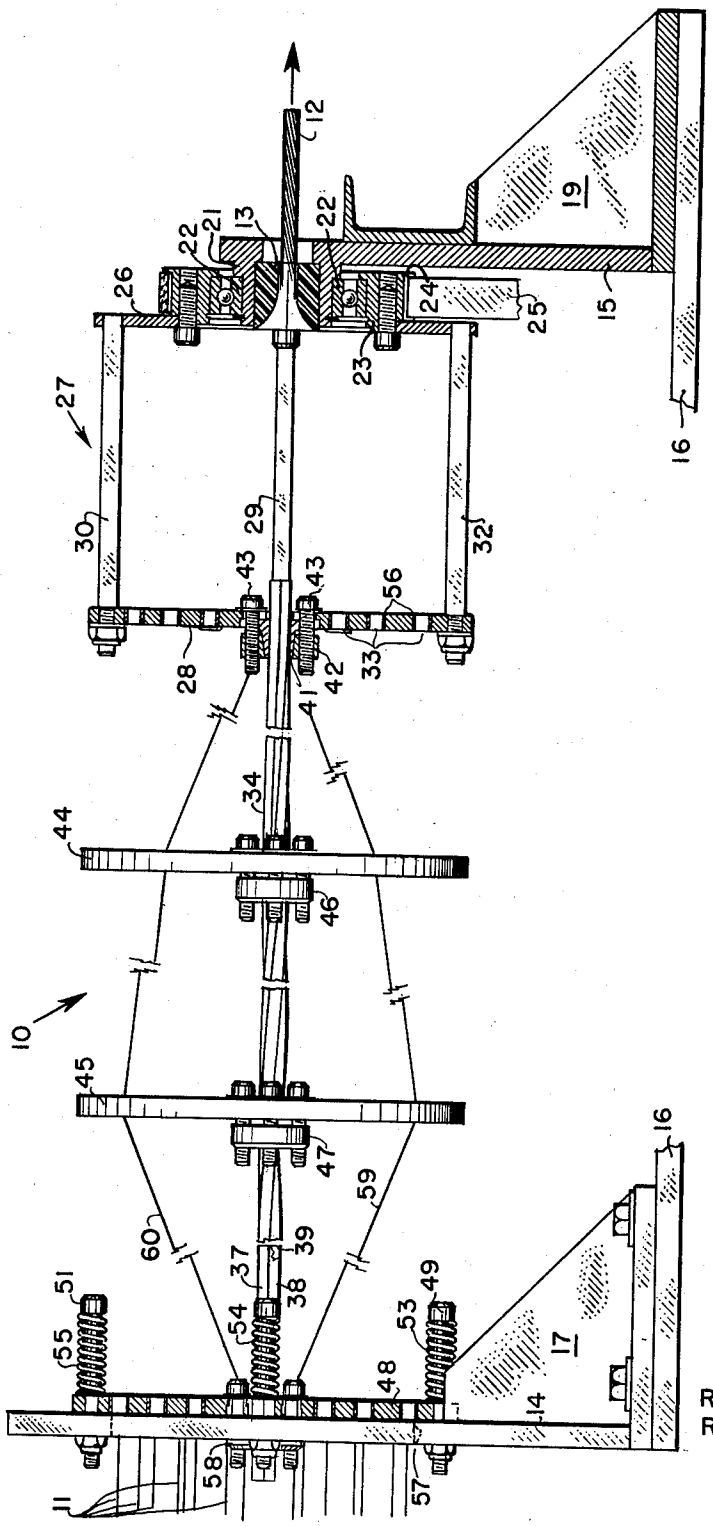


Fig. 1

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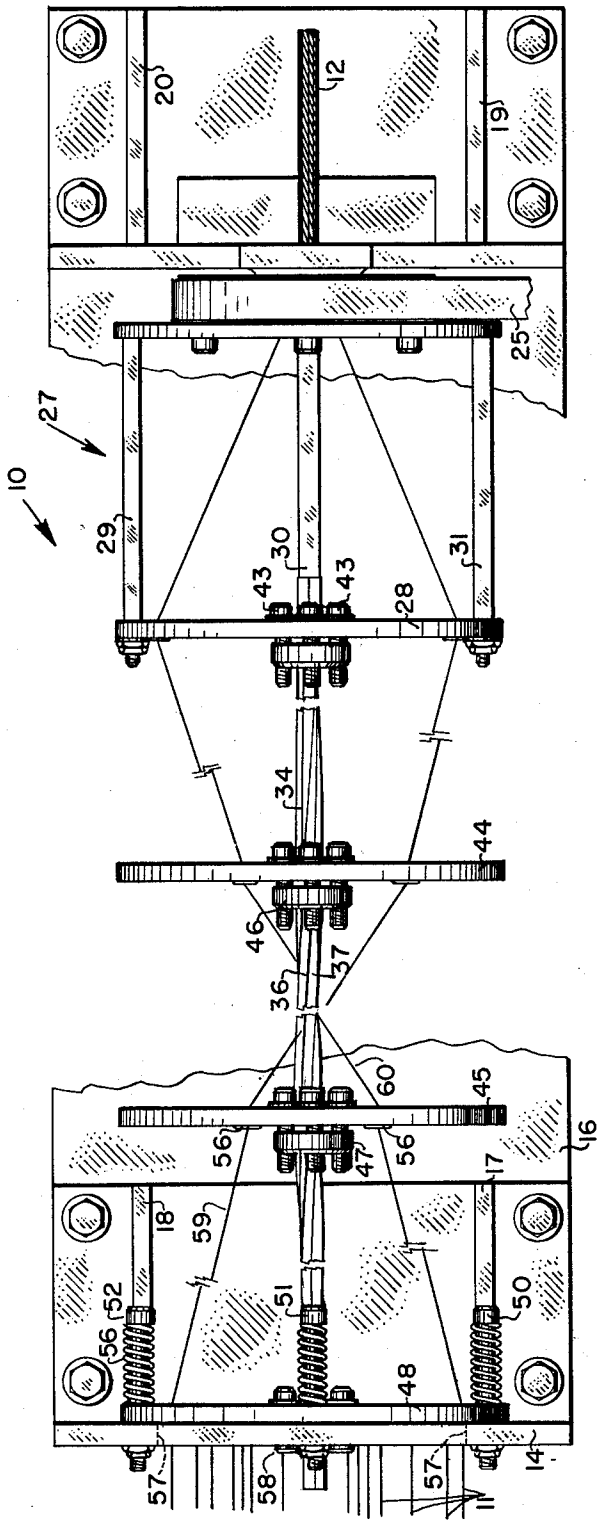


Fig. 2

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STRANDER

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6 Claims. (Cl. 57—34)

Our invention relates to strand twisting apparatus and particularly to apparatus for imparting a false twist to advancing strands.

In the manufacture of cables such as electric cables made up of a plurality of strands such as insulated conductors it has become known to cable the strands with a false or alternating twist rather than twist them in a continuous helix. This has the advantage that it can be accomplished at high speed with light-weight equipment, but even more important the cabling operation can be a continuous intermediary process of a more complex operation. This follows from the fact that the application of a false twist to advancing strands does not require a separate reeling or unreeling step.

It has, however, been a shortcoming of known apparatus for applying a false twist that the twisting angle is severely limited, usually to 180° or less due to the fact that the lay plate by means of which the twist is imparted necessarily twists the strands both upstream and downstream, and the upstream twist, if it is too great, tangles the strands and prevents them from advancing through the plate.

We have discovered that upstream tangles in advancing strand can be prevented by applying the twist in graduated steps, and have invented apparatus twisting advancing strands, comprising means for advancing a plurality of strands, first means imparting a false twist of a selected angle to the strands and second means mounted upstream of the first means imparting a twist to the strands. The twist imparted by the second means is in the same direction but of lesser angle than the false twist imparted by the first means.

Instead of a single means we may have a plurality of twisting means upstream of the first means. These means are mounted at consecutive stations and impart consecutively lesser angles of twist to the strand as they are removed from the first means. A second means is advantageously mounted upstream of the first means restraining the strands from rotation, with the angle of twist imparted by each of a plurality of intermediate twisting means being proportional to its distance from the second means.

Advantageously the twisting and restraining means may be lay plates rigidly mounted on a torsion bar.

A more thorough understanding of our invention may be obtained by referring to the appended drawing.

In the drawing:

FIGURE 1 is a partially sectionalized side view of an apparatus of our invention.

FIGURE 2 is a plan view of the apparatus of FIGURE 1.

Referring to the figures an apparatus indicated generally by the numeral **10** applies a false or reverse twist to a plurality of strands **11**. The strands **11** are formed into a cable **12** by a forming die **13** and cable **12** is continuously advanced by means not shown, thereby also advancing the strands **11** through the apparatus **10**. In the apparatus **10** a vertical plate **14** is rigidly mounted on a base plate **16** by means of brackets **17, 18**. Downstream of the plate **14** another plate **15** is also rigidly mounted to the base **16** by means of brackets **19, 20**. A die holder **21** which holds the forming die **13** is welded to the plate **15**. The die holder **21** supports the inner race **22** of a ball bearing **23** on which a sprocket **24** attached to a plate **26** is free to rotate, driven through a timing belt **25** by drive

means not shown. The plate **26** forms the end portion of a rigid frame **27** with an opposing lay plate **28** held to the frame **27** by means of welded rods **29, 30, 31, 32**. The lay plate is pierced by a plurality of openings **33** for the passage of the strands **11**.

The lay plate **28** is rigidly clamped to a torsion bar **34** made up of four square steel rods **36, 37, 38, 39** by means of a hub **41** and clamp ring **42**. The hub **41** is locked on the composite bar **34** by turning bolts **43, 43** which thread into the ring **42**. Spaced at equal distances between the plates **28** and **14** are two additional lay plates **44, 45** each perforated to match the perforations in the plate **28**. These plates are locked to the bar **34** by hub and ring clamps **46, 47** of the type used for the plate **28**, and a fourth perforated plate **48** is bolted to the plate **14** in line with the plates **45, 44, 28**. The plate **48** has a slide fit on bolts **49, 50, 51, 52** and is held against the plate **14** by compression springs **53, 54, 55, 56**. The plate **14** has a central hole **57** of diameter great enough to encompass the area of the perforations in the plate **48** which match those in the plate **28**. The plate **48** is also locked to the torsion bar **34** by means of a hub and clamp **58**. The bolts and springs **49–54** restrain the plate **48** from rotation but permit it to move horizontally to compensate for any shortening of the bar **34** when it is twisted.

The bar **34** is fixed on one end to the stationary plate **48** and on the other to the oscillating plate **28** which causes the rod to twist with the degree of twisting of any section proportional to its distance from the plate **48**. The plates **45, 44** are clamped to the bar **34** and they are caused to twist through an angle depending upon the angular twist in the bar at the section to which they are clamped. In the figures the plate **28** has been twisted 180° clockwise of the plate **48** and strands **59, 60** are selected from the strands **11** to illustrate the path taken through our apparatus. The perforations **33** in the plate **28** and, similarly, the perforations in the plates **44, 45** are advantageously lined with ceramic bushings **56** to reduce the wear on the plates and abrasion of the strands. If the bushings are omitted the perforations **33** will, in any event, be highly polished with rounded edges. In the manufacture of telephone cables for which our apparatus is particularly useful it is usual to form cable cores of 25 conductor-pairs and the lay plates **48, 45, 44, 28** will have at least 25 strand guide holes **33** with 25 pairs of cables being stranded therethrough.

In the absence of the plates **44, 45** the strands **59, 60** would rub against each other at a point midway between the plates **48** and **28** when the plate **28** had turned 180° as shown in the drawing. In addition the strand **59** would abrade against all the other strands as it advanced. In fact, each of the strands would have a point of abrasion against each of the others and, of course, if the plate **28** were turned more than 180°, the tangle of the strands upstream of the plate **28** would rapidly become unmanageable.

In our apparatus the strands **59** and **60** do not touch each other or any other of the strands **11** and make contact only with the polished ceramic bushings **56**. The perforations in the plates are selected on a minimum radius that will also assure that all strands remain clear of the bar **34** and the clamps **46, 47, 42**. Although we have illustrated an apparatus in which the plate **28** is oscillated through an angle of 180° in either direction for a total lay-twist of 360° and have provided the two intermediate plates **44, 45** it will be understood that the plate **28** might readily be rotated through a lesser or greater angle and that additional lay plates, or only one, may be clamped on the bar **34** within the scope of our invention.

Generally speaking, the greater the angle of oscillation

applied to the plate 28 the greater will be the number of intermediate lay plates that are necessary to prevent upstream tangles and, of course, if the angle of twist is small enough, no intermediate plates at all will be needed and our invention will not be applicable. We believe that where half-twists of 90° or more are applied at least one intermediate plate is useful since this will help reduce tangles due to slack that may accumulate in the strands and whipping action when the apparatus is operated at high speed.

The torsion bar combination that we have invented is a convenient and inexpensive means of obtaining proportional degrees of twist in the intermediate lay plates of our invention, but it will be understood that the plates **44, 45, 28** might be mounted on bearings and oscillated by means of belts or chains around their peripheries and driven by wheels or sprockets having diameters selected to give the appropriate angle of rotation.

We have invented a new and useful apparatus for which we desire an award of Letters Patent.

We claim:

1. Apparatus for twisting advancing strands to form a false-twisted cable, comprising:
   (A) first means for imparting a false twist of a selected angle to said strands, and
   (B) a plurality of twisting means mounted at consecutive stations upstream of said first means,
   (C) said twisting means imparting consecutively lesser angles of twist to said strands as said twisting means are removed from said first means.

2. Apparatus for twisting advancing strands to form a false-twisted cable, comprising:
   (A) first means for imparting a false twist of a selected angle to said strands,
   (B) second means upstream of said first means for restraining said strands from twisting, and
   (C) a plurality of twisting means mounted between said first and said second means,
   (D) each of said twisting means imparting a twist to said strands proportional to its distance from said second means.

3. Apparatus for twisting advancing strands, comprising:
   (A) a first perforated lay plate mounted in the path of said strands imparting a false twist thereto,
   (B) means for oscillating said lay plate through a selected angle,
   (C) a stationary perforated lay plate mounted upstream of said first plate,
   (D) a torsion bar rigidly attached to said first and said stationary plates,
   (E) at least one intermediate perforated lay plate rigidly attached to said torsion bar between said first and said stationary lay plates, said torsion bar imparting a twist to said intermediate plate proportional to its distance from said stationary plate.

4. Apparatus for twisting advancing strands, comprising:
   (A) a first lay plate mounted in the path of said strands imparting a false twist thereto,
   (B) means for oscillating said lay plate through a selected angle,
   (C) a plurality of lay plates mounted at spaced intervals in the path of said strands upstream of said first plate,
   (D) means for oscillating each of said plurality of plates through an angle dependent on its distance from said first plate.

5. Apparatus for twisting advancing strands, comprising:
   (A) a first perforated lay plate mounted in the path of said strands imparting a false twist thereto,
   (B) means oscillating said lay plate through a selected angle,
   (C) a stationary perforated lay plate mounted in the path of said strands upstream of said first plate,
   (D) at least one intermediate perforated lay plate mounted in the path of said strands between said first plate and said stationary plate, and
   (E) means oscillating said intermediate plate at an angle less than the angle of oscillation of said first plate.

6. Apparatus for twisting advancing strands, comprising:
   (A) a first perforated lay plate mounted in the path of said strands imparting a false twist thereto,
   (B) means oscillating said lay plate through a selected angle,
   (C) a stationary perforated lay plate mounted in the path of said strands upstream of said first plate,
   (D) at least one intermediate perforated lay plate mounted in the path of said strands between said first plate and said stationary plate, and
   (E) means oscillating said intermediate plate at an angle less than the angle of oscillation of said first plate in proportion to its distance from said stationary plate.

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