Aug. 11, 1931.

F. FESSL

1,818,845

METHOD OF AND MACHINE FOR STRANDING SPECIAL OR FIGURED WIRES

Filed Dec. 5, 1929

3 Sheets-Sheet 1

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

INVENTOR
Ferdinand Fessl

BY

ATTORNEYS
METHOD OF AND MACHINE FOR STRANDING SPECIAL OR FIGURED WIRES

Filed Dec. 5, 1929

3 Sheets—Sheet 2

Fig. 6

Fig. 8

Fig. 7

Fig. 13

Fig. 12

INVENTOR

Ferdinand Fessl

BY

Mundare

ATTORNEYS
The invention relates to a method of and machine for stranding special or non-circular wires, more particularly such wires having a comparatively large transverse section and made of a material of high tensile strength and great rigidity as used in the manufacture of heavy wire ropes, cables and cable coverings.

The object of the present invention is to provide a stranding method and a stranding machine whereby the untwisting and unravelling of the wire ropes and the like is prevented with certainty.

The present method is very simple and reliable and the machine for carrying the method into practice is likewise very simple in construction and reliable in operation. Any existing stranding machine suitable for stranding wires such as above referred to may be readily adapted for carrying out the improved method.

For facilitating the understanding of the invention first the machine and then the method will be described with reference to the machine.

In the annexed drawings embodiments of the present invention are shown by way of example and in part diagrammatically. Fig. 1 is a transverse section of a wire rope provided with a covering of stranded wires S or Z shaped in transverse section. Fig. 2 is a sectional elevation of the parts of the improved stranding machine which are essential for the present invention. Fig. 3 is a front elevation of one of the rings supporting the guiding element. Figs. 4 and 5 are front elevations of guiding discs. Figs. 6, 7, 8 show diagrammatically in side elevation, plan view and front elevation respectively an individual wire to be stranded on its way from the guiding device to the stranding die.

Figs. 9, 10, and 11 illustrate on a larger scale the actual distortion of a wire while passing through the stranding die; Fig. 12 shows a simple guiding disc for the wires to be stranded; Fig. 13 is a diagrammatical front elevation of a slightly modified guiding disc.

In the following description it will be assumed, that around a core 1, Fig. 1 of a wire rope a layer or covering of steel wires 2 has to be wound such layer being composed of wires of a comparatively large S or Z shaped transverse section closely wound around the core and interlocking with each other in the usual manner.

As shown in Fig. 2 the essential parts of the machine according to the present invention are two parallel discs 3, 4 perpendicular to the axis of the core of the wire rope and provided with notches 5 and 6 respectively at their peripheries for guiding the wires 2 to be stranded to the stranding die 7.

At least the notches 5 in the disc 3 are so shaped that they snugly enclose the transverse section of the wires 2, so that these wires cannot turn around their axes in the said notches. The stranding die 7 is mounted in a third disc 8 which is parallel to the discs 3 and 4. The disc 8 is held in position by screw threaded rods 9 secured to the stranding cage 10 of any suitable or preferred construction. The rods 9 are parallel to the axis of the core 1 and carry rings 11, 12 located in planes perpendicular to the axis of the core. Within the ring 11 the disc 3 and within the ring 12 the disc 4 is detachably secured in any suitable or preferred manner.

The rings 11 and 12 with the discs 3 and 4 as also the disc 8 may be adjusted along the screw threaded rods 9 and locked in any position to which they may be adjusted by means of nuts 13 screwed onto the rods 9. Moreover in order to enable the discs 3, 4 to be turned relatively to each other in their respective parallel planes the rings 11, 12 are provided with segmental openings 14, Fig. 3 through which pass the rods 9. The discs 3, 4 with the notches 5, 6 constitute the guiding device for the wires.

For bringing the machine into operating condition, first the core 1 is brought into operating position and introduced into the stranding die. Furthermore the required number of wires 2, S shaped in transverse section is drawn from the stranding cage through the notches 5 and 6 of the guiding device and introduced into the stranding
2 die. The operation of the machine constituting the method according to the present invention may now be described as follows:

Assuming at first that the notches 5, 6 of the guide discs 3 and 4 respectively through which passes an individual wire 2, as diagrammatically shown in Fig. 8 are in one plane with the axis of the core 1. For the sake of simplicity the wire 2 is shown in Figs. 6, 7 and 8 as being rectangular in transverse section. Owing to the revolution of the stranding cage in the direction of the arrow, the notches 5 and 6 for the individual wire 2, which wire, at a given moment, occupies a position on the core as indicated in Fig. 8, will have arrived at the same moment in a position shown in Fig. 8, in which position the angle \( \alpha \) is formed between two planes the first of which is defined on one hand by the axis of the core and on the other hand by the main axis of the cross section of the wire 2 at the point where it leaves the notch, the other plane being defined on one hand by the axis of the core and on the other hand by the main axis of the cross section of the wire 2 at the point where it leaves the core 1. The feeding angle is made considerably greater by increasing at least one of these angles \( \alpha \) and \( \beta \). While this results in a very marked increase of the resistance in the stranding die and hence also the heating but the wires to be stranded are not appreciably affected, as regards their essential mechanical properties. The great and decisive advantage due to the increase of the feeding angle consists, as has been ascertained by careful investigation, in the intense distortion of the wire 2 during the beginning of its passage through the stranding die. This intense distortion is not at all detrimental but on the contrary very advantageous since owing to the same the wire 2 acquires a continuous curvature and torsion by which any tendency of the wire to untwist or unravel is efficiently counteracted and eliminated. This new and surprising effect due to the increase of the feeding angle may possibly be explained as follows:

When an individual wire enters the cylindrical part of the stranding die 2 it finds itself clamped between the inner surface of the stranding die 7 the outer surface of the core 1 and the neighbouring wires 2 and at the same time this wire is sharply bent owing to the great feeding angle, as is clearly shown in Figs. 9, 10 and 11 in which 15 indicates the point at which the wire 2 enters the cylindrical part of the stranding die and engages with the neighbouring wires.

Fig. 11 shows a wire S-shaped in transverse section as projected on a plane parallel to its outer flange in the point 15. This wire was taken from a rope actually made according to the present invention which rope did not show any tendency to untwist or unravel. Fig. 10 shows the same wire in the same projection as stranded and in engagement with the neighbouring wires, the stranding die being shown in longitudinal section. Fig. 9 shows the same wire as projected on a plane parallel to the web of this wire in the point 15.

At this point 15 the outer flange of the wire shows a marked bend in its plane. Owing to this bend the individual fibres of the wire which are perpendicular to its transverse section are stretched to a different extent so that at least some of the said fibres will be stretched beyond the limit of elasticity and if this is properly done the wire acquires that permanent distortion and curvature which is necessary for each individual wire if the untwisting and unraveling of the rope has to be avoided.

The extent of stretching of the various fibres of the wire in the point 15 depends on the absolute value of the feeding angle and on the proportion of its projections, \( \alpha \) and \( \beta \) that is to say of its radial and tangential components respectively. The most suitable value of these angles depends of course on the tensile strength and elasticity of the
wires 2 and also on the size and shape of their transverse section.

Therefore no definite rules for determining these angles can be given, they must be determined by experiment.

For this purpose the stranding die 7 is axially adjustable together with the disc 8 relatively to the disc 4 as above described whereby the angle \( \beta \) may be varied.

It will be understood from the above that all other things being equal, the angle \( \beta \) will increase as the angle \( \alpha \) increases. But in most cases it will be necessary to adjust the angle \( \beta \) independently of the angle \( \alpha \). Therefore the disc 4 must be adjustable relatively to the stranding die 7 by turning it around the axis of said stranding die. This may be facilitated by means of the segmental slots 14 in the ring 12. The locking in position is effected by means of the nuts 13 on the screw threaded rods 9 as above described.

A further possibility of varying the angle \( \beta \) consists in that the discs 3 and 4 are adapted to be turned relatively to one another around the axis of the stranding die by means of the said segmental slots 14 in the rings 11 and 12 whereupon the rings may be locked in position by the said nuts. Another way of arriving at this result is to incline the notches in the disc 4 at an angle to the associated generatrices of the beveled edge of the disc, provided the notches snugly fit the transverse section of the wire. This is shown in Fig. 12 in which \( \gamma \) indicates the projection of the angle \( \gamma \). The edges of the notches are preferably rounded off for avoiding excessive friction and wear of the wires 2.

In some cases it will be advisable to impart independently of the angle \( \beta \) a torsion to the wires 2 which may be greater or less than that corresponding to the angle \( \gamma \) in Fig. 8. This may be accomplished by making the notches 5 in the disc 3 or the notches 6 in the disc 4, provided the latter notches snugly fit the wire, inclined to their corresponding radii as shown in Fig. 13.

The discs 3 and 4 are detachably secured to the rings 11 and 12 respectively and may be readily removed and replaced by others having notches differing in number or size and shape as circumstances may require. In some cases the disc 3 and the ring 11 of Fig. 2 may be dispensed with. In this case the notches 6 in the disc 4 must closely fit the transverse section of the wires. In this case the possibilities of adjustment of the various parts are reduced, but nevertheless perfectly satisfactory results may be obtained in many cases, but in this case too the disc 4 and stranding die 7 must be adjustable axially relatively to one another.

What I claim is:

1. A method of stranding non-circular wires to form a cylindrical layer comprising the step of feeding the wires into the stranding die at an angle greater than the stranding angle, the radial and the tangential components of the angle being such that the wires on entering the stranding die undergo a distortion beyond the limit of elasticity whereby any tendency of the wires to un twist or unravel from their stranded position is at least partly eliminated.

2. A stranding machine comprising a feeding device having guiding notches for the wires to be stranded, a stranding die coaxial with such feeding device, and means for adjusting the guiding device and the stranding die relatively to each other axially as well as by turning them relatively to each other around their common axis for feeding the wires to the stranding die at a feeding angle greater than the stranding angle, the projection of the said feeding angle on two radial planes of the stranding die, the first passing through the point at which the wire enters the said stranding die and the second being perpendicular to the first, the two projections of said feeding angle being such that the wires on entering the stranding die undergo a distortion beyond the limit of elasticity whereby any tendency of the wires to untwist or unravel from their stranded position is at least partly eliminated.

3. A stranding machine comprising a feeding device having guiding notches for the wires to be stranded, such notches being inclined tangentially to the axis of the said feeding device, a stranding die coaxial with such feeding device, and means for adjusting the guiding device and the stranding die relatively to each other axially as well as by turning them relatively to each other around their common axis, for feeding the wires to the stranding die at a feeding angle greater than the stranding angle, the projection of the said feeding angle on two radial planes of the stranding die, the first passing through the point at which the wire enters the said stranding die and the second being perpendicular to the first, the two projections of said feeding angle being such that the wires on entering the stranding die undergo a distortion beyond the limit of elasticity whereby any tendency of the wires to untwist or unravel from their stranded position is at least partly eliminated.

4. A stranding machine comprising a feeding device having guiding notches for the wires to be stranded, such notches being inclined tangentially to the axis of the said feeding device and snugly fitting the transverse section of the wire to be stranded, the main axis of each of such notches being inclined to the corresponding radius of the guiding device, a stranding die coaxial to such feeding device, and means for adjusting the guiding device and the stranding die relatively to each other axially as well as by...
turning them relatively to each other around their common axis for feeding the wire to the stranding die at a feeding angle greater than the stranding angle, the projections of the said feeding angle on two radial planes of the stranding die, the first passing through the point at which the wire enters the said stranding die and the second being perpendicular to the first, the two projections of said feeding angle being such that the wires on entering the stranding die undergo a distortion beyond the limit of elasticity, whereby any tendency of the wires to untwist or unravel from said stranded position is at least partly eliminated.

5. A stranding machine comprising a guiding device provided with two parallel coaxial guiding discs, each provided with guiding notches for guiding the wire to be stranded, a stranding die coaxial with the said guiding disc, and means for adjusting the said guiding discs and the stranding die relatively to each other axially as well as by turning them relatively to each other around their common axis for feeding the wires to the stranding die at a feeding angle greater than the stranding angle, the projections of the said feeding angle on two radial planes of the stranding die, the first passing through the point at which the wire enters the said stranding die, and the second being perpendicular to the first, the two projections of said feeding angle being such that the wires on entering the stranding die undergo a distortion beyond the limit of elasticity whereby any tendency of the wires to untwist or unravel from their stranded position is at least partly eliminated.

6. A stranding machine comprising a guiding device provided with two parallel coaxial guiding discs, each provided with guiding notches for guiding the wires to be stranded, means for adjusting such discs axially as well as by turning them relatively to each other around their common axis, a stranding die coaxial with the said guiding discs, and means for adjusting the said guiding discs and the stranding die relatively to each other, axially as well as by turning them relatively to each other around their common axis for feeding the wires to the stranding die at a feeding angle greater than the stranding angle, the projection of the said feeding angle on two radial planes of the stranding die the first passing through the point at which the wire enters the said stranding die and the second being perpendicular to the first, the two projections of said feeding angle being such that the wires on entering the stranding die undergo a distortion beyond the limit of elasticity, whereby any tendency of the wires to untwist or unravel from their stranded position is at least partly eliminated.

7. A stranding machine comprising a stranding cage, a guiding device provided with two parallel coaxial guiding discs, each provided with guiding notches for guiding the wires to be stranded, means for adjusting such discs axially as well as by turning them relatively to each other around their common axis, such means comprising two rings coaxial with the stranding die, said rings, having openings near their peripheries, such openings being segment-shaped in at least one of the said rings, each of the said rings having a central opening, means for securing each of the said guide discs in the central opening of one of the said rings, screw threaded rods, secured to the stranding cage and passing through the opening near the periphery of the said rings, nuts screwed onto the said screw threaded rods and adapted to lock the said rings in position, a stranding die coaxial with the said guiding discs, and means for adjusting the said guiding discs and the stranding die relatively to each other axially as well as by turning them relatively to each other around their common axis for feeding the wires to the stranding die at a feeding angle greater than the stranding angle, the projections of the said feeding angle on two radial planes of the stranding die, the first passing through the point at which the wire enters the said stranding die, and the second being perpendicular to the first, the two projections of said feeding angle being such that the wires on entering the stranding die undergo a distortion beyond the limit of elasticity, whereby any tendency of the wires to untwist or unravel from their stranded position is at least partly eliminated.

8. A stranding machine comprising a stranding cage, a guiding device provided with two parallel coaxial guiding discs, each provided with notches for guiding the wires to be stranded, a stranding die coaxial with the said guiding discs, and means for adjusting the said guiding discs and the stranding die relatively to each other axially as well as by turning them relatively to each other around their common axis for feeding the wires to the stranding die at a feeding angle greater than the stranding angle, the projections of the said feeding angle on two radial planes of the stranding die, the first passing through the point at which the wire enters the said stranding die and the second being perpendicular to the first, the two projections of said feeding angle being such that the wires on entering the stranding die undergo a distortion beyond the limit of elasticity whereby any tendency of the wires to untwist or unravel from their stranded position is at least partly eliminated, the said adjusting means for the guiding discs and the stranding die comprising two rings coaxial with the stranding
die, said rings having openings near their peripheries, such openings being segment-shaped in at least one of said rings, each of said rings having a central opening, means for securing each of the said guide discs in the central opening of one of the said rings, a disc, means for securing the stranding die to the said disc, the last named disc having openings near its periphery, screw threaded rods secured to the stranding cage and passing through the openings near the periphery of the said rings and the stranding die disc, and nuts screwed onto the said screw threaded rods and adapted to lock the said rings and the last named stranding die disc in position.

In testimony whereof I have affixed my signature.

FERDINAND FESSL.