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PATENT SPECIFICATION

865,537

DRAWINGS ATTACHED.



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International Classification :—B23p.

COMPLETE SPECIFICATION.

Improvements in or relating to Reinforcement Rods for Concrete Structures.

We, TOR-ISTEG STEEL CORPORATION S.A.H., a Corporation organised under the laws of the Grand Duchy of Luxemburg, of 10 Boulevard Royal, Luxemburg, Grand Duchy of Luxemburg, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 This invention relates to reinforcement rods for use in concrete structures.

It is known to provide a steel reinforcement rod having at least two helical ribs extending over the whole length of the rod, the helical formation of the ribs being obtained by twisting the rod about its own longitudinal axis after rolling. It is also known to provide a reinforcement rod with inclined ribs disposed between continuous longitudinal ribs, the inclined ribs extending from one longitudinal rib to the other or else being of shorter length.

25 It has been found that rods constructed and treated in the manner described hereinbefore are not always suitable for use in the reinforcement of concrete. When the rods are bent at the building site, fractures occasionally occur at the bends. In most cases the fractures proceed from the inclined ribs bearing on the bending roller.

30 According to the present invention there is provided a reinforcement rod for concrete, the rod comprising a core devoid of external longitudinal grooves or depressions but formed along the exterior thereof with longitudinal ribs or edge portions, and formed also with transverse ribs which are disposed between and all similarly inclined with respect to the longitudinal ribs or edge portions, the rod being cold-twisted about its longitudinal axis in such a manner as to

extend the transverse ribs in the direction of their length and to deform the longitudinal ribs or edge portions into non-parallel relationship with respect to the axis of the rod. 45

The cold-twisting of the rod may be effected in such a manner that, when in the pre-twisted state of the rod, the inclined transverse ribs extend from the lower left to the upper right as viewed from the front in the upright position of the rod, the upper end of the rod is twisted to the right relatively to the lower end of the rod. But when, in the pre-twisted state of the reinforcement rod, the inclined transverse ribs extend from the lower right to the upper left as viewed from the front in the upright position of the rod, the upper end of the rod is twisted to the left relatively to the lower end of the rod. 50 55 60

From bending-back tests after natural and artificial ageing, it has been found that besides the inclination of the inclined ribs relatively to the rod axis, the direction of twist has a certain relation to the fracture behaviour of the rod. It has been found that by cold-twisting reinforcement rods in a direction following the inclination of the inclined transverse ribs relatively to the longitudinal axes of the rods so as to extend the transverse ribs in the direction of their length, the rods are less liable to brittle fracture than in cases where the rods are twisted in directions opposite to the inclination of the inclined ribs. 65 70 75

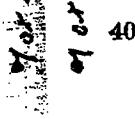
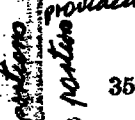
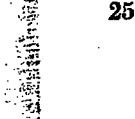
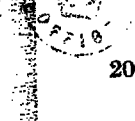
This advantageous effect is believed to be due to the fact that at the time of bending, the short inclined ribs which previously were situated transversely to the direction of twist, could not be deformed to the same extent as the surrounding longitudinal fibres. 80

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throughout the cold-twisting operation
of or edge portions



The stress condition produced by this transverse position of the ribs at the time of twisting, in conjunction with the bending or bending-back stresses, appear to lead to stress peaks which cannot be accepted by the rod surface. On the other hand, if the rods are twisted in the direction of inclination of the inclined ribs, so that the longitudinal fibres at the surface of the rods are situated substantially in the direction of the inclined ribs, during all further stressing caused by the bending or bending-back, the stresses can travel unhindered over the surface of the rod.

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made to the accompanying diagrammatic drawings, in which:—

Figure 1 is a fragmentary elevational view of a rod section for the formation of a reinforcement rod according to one example of the invention; and

Figures 2 to 4 are views, similar to Figure 1, and illustrating further examples of the invention.

Each of the rod sections illustrated is formed of steel and comprises a core 1 which is circular in cross-section and devoid of external longitudinal grooves or depressions. The core is formed along the exterior thereof with longitudinal ribs 2 which are parallel with the longitudinal axis of the core. The core is also formed with transverse ribs disposed between and all similarly inclined with respect to the longitudinal ribs 2. In the examples of Figures 1 and 3, the transverse ribs which are shown at 3 are of such a length as to extend between the longitudinal ribs 2 and to engage into the flanks thereof. In the examples of Figures 2 and 4, however, the transverse ribs which are shown at 4, terminate before reaching the longitudinal ribs 2.

In Figures 1 and 2, the inclined transverse ribs 3 and 4 are shown as extending from the lower left to the upper right and, in the formation of the reinforcing rods, these rod sections are twisted about the longitudinal axes thereof in a direction such that the upper ends of the rods are twisted towards the right, as indicated by the arrows 5, relatively to the lower ends thereof. In the case of the rod sections of Figures 3 and 4, however, the inclined transverse ribs 3 and 4 extend from the lower right to the upper left and accordingly these rod sections are twisted about the axes thereof in a direction such that the upper ends of the rods are twisted towards the left, as shown by the arrows 6, relatively to the lower ends thereof. In each case, the rod is cold-twisted and the twisting is such as to extend the transverse ribs in the direction of the length thereof and to deform each longitudinal rib into

a non-parallel relationship with respect to the longitudinal axis of the rod.

The transverse ribs 3 and 4 may be inclined more or less to the longitudinal axis of the core 1.

The cross-section of the rods illustrated in the drawings should be regarded as merely an example of embodiment. Instead of being round or approximately round, the rods may be of polygonal shape in cross-section, i.e. the rods may be square, hexagonal, octagonal, or even triangular, in cross-section.

In the case, for example, of a rod having a core which is square in cross-section, the corners of the square will define along the exterior of the core four longitudinal edges which effectively constitute or are equivalent to the longitudinal ribs. In such an arrangement, the inclined transverse ribs will extend between the longitudinal edges across one at least of the flat external faces of the core. The rod is then cold-twisted about its axis in accordance with the direction of inclination of the inclined transverse ribs, in the manner already described with reference to Figures 1 to 4.

WHAT WE CLAIM IS:—

1. A reinforcement rod for concrete, the rod comprising a core devoid of external longitudinal grooves or depressions but formed along the exterior thereof with longitudinal ribs or edge portions, and formed also with transverse ribs which are disposed between and all similarly inclined with respect to the longitudinal ribs or edge portions, the rod being cold-twisted about its longitudinal axis in such a manner as to extend the transverse ribs in the direction of their length and to deform the longitudinal ribs or edge portions into non-parallel relationship with respect to the axis of the rod.

2. A rod as claimed in Claim 1 wherein, in the pre-twisted state, when the inclined transverse ribs extend from the lower left to the upper right in the upright position of the rod, the upper end of the rod is twisted to the right relatively to the lower end thereof.

3. A rod as claimed in Claim 1 wherein, in the pre-twisted state, when the inclined transverse ribs extend from the lower right to the upper left in the upright position of the rod, the upper end of the rod is twisted to the left relatively to the lower end thereof.

4. A rod as claimed in any preceding claim, wherein the inclined transverse ribs each engage at least once in the flanks of the longitudinal ribs.

5. A rod as claimed in any one of Claims 1 to 3, wherein the inclined transverse ribs terminate before reaching the longitudinal ribs.

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1. If circular cross-section and 1/2 through the core in any position of edge portions

The stress condition produced by this transverse position of the ribs at the time of twisting, in conjunction with the bending or bending-back stresses, appear to lead to stress peaks which cannot be accepted by the rod surface. On the other hand, if the rods are twisted in the direction of inclination of the inclined ribs, so that the longitudinal fibres at the surface of the rods are situated substantially in the direction of the inclined ribs, during all further stressing caused by the bending or bending-back, the stresses can travel unhindered over the surface of the rod.

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made to the accompanying diagrammatic drawings, in which:—

Figure 1 is a fragmentary elevational view of a rod section for the formation of a reinforcement rod according to one example of the invention; and

Figures 2 to 4 are views, similar to Figure 1, and illustrating further examples of the invention.

Each of the rod sections illustrated is formed of steel and comprises a core 1 which is circular in cross-section and devoid of external longitudinal grooves or depressions. The core is formed along the exterior thereof with longitudinal ribs 2 which are parallel with the longitudinal axis of the core. The core is also formed with transverse ribs disposed between and all similarly inclined with respect to the longitudinal ribs 2. In the examples of Figures 1 and 3, the transverse ribs which are shown at 3 are of such a length as to extend between the longitudinal ribs 2 and to engage into the flanks thereof. In the examples of Figures 2 and 4, however, the transverse ribs which are shown at 4, terminate before reaching the longitudinal ribs 2.

In Figures 1 and 2, the inclined transverse ribs 3 and 4 are shown as extending from the lower left to the upper right and, in the formation of the reinforcement rods, these rod sections are twisted about the longitudinal axes thereof in a direction such that the upper ends of the rods are twisted towards the right, as indicated by the arrows 5, relatively to the lower ends thereof. In the case of the rod sections of Figures 3 and 4, however, the inclined transverse ribs 3 and 4 extend from the lower right to the upper left and accordingly these rod sections are twisted about the axes thereof in a direction such that the upper ends of the rods are twisted towards the left, as shown by the arrows 6, relatively to the lower ends thereof. In each case, the rod is cold-twisted and the twisting is such as to extend the transverse ribs in the direction of the length thereof and to deform each longitudinal rib into

a non-parallel relationship with respect to the longitudinal axis of the rod.

The transverse ribs 3 and 4 may be inclined more or less to the longitudinal axis of the core 1.

The cross-section of the rods illustrated in the drawings should be regarded as merely an example of embodiment. Instead of being round or approximately round, the rods may be of polygonal shape in cross-section, i.e. the rods may be square, hexagonal, octagonal, or even triangular, in cross-section.

In the case, for example, of a rod having a core which is square in cross-section, the corners of the square will define along the exterior of the core four longitudinal edges which effectively constitute or are equivalent to the longitudinal ribs. In such an arrangement, the inclined transverse ribs will extend between the longitudinal edges across one at least of the flat external faces of the core. The rod is then cold-twisted about its axis in accordance with the direction of inclination of the inclined transverse ribs, in the manner already described with reference to Figures 1 to 4.

WHAT WE CLAIM IS:—

1. A reinforcement rod for concrete, the rod comprising a core devoid of external longitudinal grooves or depressions but formed along the exterior thereof with longitudinal ribs or edge portions, and formed also with transverse ribs which are disposed between and all similarly inclined with respect to the longitudinal ribs or edge portions, the rod being cold-twisted about its longitudinal axis in such a manner as to extend the transverse ribs in the direction of their length and to deform the longitudinal ribs or edge portions into non-parallel relationship with respect to the axis of the rod.

2. A rod as claimed in Claim 1 wherein, in the pre-twisted state, when the inclined transverse ribs extend from the lower left to the upper right in the upright position of the rod, the upper end of the rod is twisted to the right relatively to the lower end thereof.

3. A rod as claimed in Claim 1 wherein, in the pre-twisted state, when the inclined transverse ribs extend from the lower right to the upper left in the upright position of the rod, the upper end of the rod is twisted to the left relatively to the lower end thereof.

4. A rod as claimed in any preceding claim, wherein the inclined transverse ribs each engage at least once in the flanks of the longitudinal ribs.

5. A rod as claimed in any one of Claims 1 to 3, wherein the inclined transverse ribs terminate before reaching the longitudinal ribs.



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1. of circular cross-section and 1. throughout the cold-twisting operation
or edge portions
or edge portions



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6. A rod as claimed in any one of the preceding claims, wherein the core is, in the pre-twisted state of the rod, of polygonal shape in cross-section, the corners of the polygon defining the longitudinal edge portions along the exterior of the rod.

7. A cold-twisted concrete reinforcement rod substantially as hereinbefore described

with reference to any one of Figures 1 to 4 of the accompanying drawings.

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