This invention generally involves wire rope which is suitable for use in the concrete working in very tall buildings or ultra high buildings. More particularly, this invention relates to a wire rope which has an extremely coarse-laid surface so as to increase adhesive strength or bond strength in respect to the placed concrete.
EXTRA COARSE-LAI D WIRE ROPE FOR REINFORCED CONCRETE

In the disclosure the extra coarse-laid wire rope is designated as a wire rope with an extremely coarse surface of wire rope lay with strands laid therearound axially along the entire length of the wire lay, and with other pieces axially provided on the lay at regular intervals, so as to effectively increase adhesive strength or bond strength, in respect to the placed concrete in the case of concrete working in tall buildings.

Wire ropes are usually built up of a number of strands of wire laid together. However, wire ropes built up in this way have smooth-faced even or level surfaces. Therefore, when such conventional wire ropes are imbedded into concrete, they have extremely small adhesive strength or bond strength in respect to the worked concrete. This is because the placed concrete is merely in contact with the surface of the imbedded wire ropes, more specifically the worked concrete merely contacts the shallow uneven parts of the lay when placed into the frames for the wire ropes. For example, when a building is affected by a large external force, the wire ropes are rubbed on the surface as they have small adhesive strength or bond strength in respect to the placed concrete, thereby the concrete becoming separated from the inert wire ropes. Consequently the wire ropes become inactive in reinforcing a bending or tensioning of the placed concrete, which is one of the weak points of concrete. The surfaces of the inert wire ropes are rubbed when in contact with the placed concrete when either the ropes or concrete, or both of them are subjected to external stress, the wire ropes are therefore so frictionally damaged at the same time their mechanical strength is so decreased that they verge upon being divided into pieces.

The present invention purports to overcome the aforesaid Short-comings and to have the wire rope effectively increase its adhesive strength or bond strength by forming the rough surface thereof comprising the lay and the strands laid around the former.

Thus, the objective of this invention is the provision of an extra coarse-laid wire rope which will effectively increase the adhesive strength or bond strength in respect to the placed concrete so that both the rope and the concrete will be tight and inseparably combined.

Another objective is, by the provision of the extra coarse-laid wire, to sufficiently increase the weak bending and tension strength, being a present short-coming of concrete, by actuating the wire rope together with the placed concrete, both of which will become tight and inseparably combined against external force.

A further objective of this invention is the provision of an extra coarse-laid wire rope which will be combined and in close contact with the concrete so that the wire rope will not be rubbed by being in friction with the latter, thereby protecting the wire rope from frictional damage.

A still further objective of this invention is the provision of an extra coarse-laid wire rope which is simply built up of strands winding around the lay.

The above described objectives and other objectives of this invention as well as the advantages of it will be further understood by reference to the description, examples and drawings below which are not limiting but are given for illustrative purposes only.

FIG. 1 is a front view of a part of the extra coarse-laid wire rope according to the first example of this invention;
FIG. 2 is taken on line II — II of FIG. 1;
FIG. 3 is a front view of a part of the extra coarse-laid wire rope according to the second example of this invention;
FIG. 4 is taken on line IV — IV of FIG. 3;
FIG. 5 is a diagrammatically schematic view of the extra coarse-laid wire rope as described in the first example wherein a plurality of such ropes are applied in the concrete working an ultra high building.
FIG. 6 is a sectional view of the extra coarse-laid wire rope imbedded into the concrete.

The extra coarse-laid wire rope according to the first example is shown in FIG. 1 and FIG. 2. NUMERAL 1 shows the extra coarse-laid wire rope, which is built up of the lay 2 and two of the wire strands 3, 4. The lay 2 is built up of strands 5, 6, 7 (shown in FIG. 2) of the wires laid together. The strands 3, 4 are laid around the surface of the lay 2 spirally. In this case, the phase angle of the crossing strands is 180° in relation to the outer surface of the lay 2. The crossing 8 of the strands 3, 4, points towards the diameter of the lay 2. The other parts of the strands unaffected by the crossings also project as high as the diameter of the laid around strands in the direction of the diameter of the lay 2, thereby forming the extremely coarse-laid surface of the wire rope 1. The laid around strands 3, 4 have the same structure as the strands 5, 6, 7 forming the lay 2.

The extra coarse-laid wire rope according to the second example is shown in FIG. 3 and FIG. 4. The lay 10 of the extra coarse-laid wire rope 9 according to the second example has the same structure as the lay 2 of the wire rope according to the first example. The same description is available for both examples. In the second example wherein the lay 10 is formed, the metal crosspieces 11, 12, 13, 14 are inserted in the lay 10 in the direction of the axis thereof at regular intervals. The ends of the crosspieces 11, 12, 13, 14 are fixedly provided by welding or screwing with top pieces 15, 16, 17, 18 in the form of a ball or the like made of iron or other material. The top pieces protruding out of each side of the wire rope lay 10 give a total width considerably larger than the diameter of the lay 10, thereby forming the extremely coarse-laid surface. Shown in FIG. 5 is the extra coarse-laid wire rope applied to the pith reinforcing bars in the ultra high building 19.

In the said drawing, NUMERAL 20 designates the joints of the extra coarse-laid wire ropes. The concrete working is made together with the above applied wire ropes according to the usual method. In this case the concrete 21 (FIG. 6) is placed into the groove 22 formed between the lay 2 and the strands 3, 4, thereby bringing it into close contact with the said strands 3, 4. The wire rope increases the adhesive strength or bond strength in respect to the combined tightness when together with the concrete.

In the case of the second example, the grooves formed between the wire rope lay and top pieces are readily accessible and can be filled with concrete, thereby building up the wire rope tightly with the concrete.

Thus, according to this invention, the wire ropes placed into the concrete have an extremely coarse sur-
face, thereby increasing their adhesive strength or bond strength in relation to the concrete because, the coarse surface of the wire rope can easily bind with the concrete. When a building is subjected to great external stress, both the extra coarse-laid wire rope and the concrete are equally affected by the stress. The bending or tension of the weak points of the concrete are sufficiently reinforced by the extra coarse-laid wire ropes. Further, the tight contact of the wire ropes with the concrete tends to make it free from any rubbing contact between them, thereby preventing frictional damage.

In the first example where two of strands are crossing on the surface of the wire rope lay, thereby building up the extra coarse-laid wire rope, as many as three of the strands can be laid up with one strand laid around the lay.

In the second example where two top pieces are fixedly provided on both ends of a crosspiece, there need not necessarily be two of them; a top piece can be provided on one end with none on the other.

Further, the type of wire rope lay is not limited to the type of wire rope described in this invention: commercial wire ropes such as standard hoisting rope, standard coarse-laid rope etc. can be employed as the lay to be laid around by strands.

Thus, while the invention has been disclosed herein in connection with the above two embodiments, it is clear that changes, modifications or equivalents can be used by those skilled in the art; accordingly, such changes within the principles of the invention are intended to be included within the scope of the claims below.

What is claimed is:

1. An extra coarse-laid wire rope for reinforced concrete building construction, comprising:
   a plurality of strands, each incorporating a plurality of wires laid helically in the same angular sense to provide a built-up lay;
   at least two strands, each incorporating a plurality of wires, said at least two strands each being of at least as great diameter as the first-mentioned strands and being helically wound in two angularly opposite senses upon said built-up lay so as to cross one another at a phase angle of about 180°;
   the at least two strands being spaced to expose said lay exteriorly of the wire rope, between the at least two strands so the wire rope has a substantially greater diameter at the crossings of said at least two strands than where said lay is exposed exteriorly of the wire rope.

2. An extra coarse-laid wire rope for reinforced concrete building construction, comprising:
   a plurality of strands, each incorporating a plurality of wires laid helically in the same angular sense to provide a built-up lay;
   a plurality of transversely extending, axially regularly spaced metallic cross pieces incorporated in said lay and having both ends of each piece protruding substantially outwardly of said lay, and ball means secured on the protruding end of each cross piece.

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