(12) INNOVATION PATENT (11) Application No. AU 2018101211 A (19) AUSTRALIAN PATENT OFFICE		\4
(54)	Title DRAGLINE AND SHOVEL ROPE	
(51)	International Patent Classification(s) D07B 1/00 (2006.01) F16G 9/00 (2006.01) E02F 3/48 (2006.01)	
(21)	Application No: 2018101211 (22) Date of Filing: 2018.08.21	
(30)	Priority Data	
(31)	Number(32)Date(33)Country20179033542017.08.21AU	
(45) (45) (45)	Publication Date:2018.09.27Publication Journal Date:2018.09.27Granted Journal Date:2018.09.27	
(71)	Applicant(s) Scaw South Africa (Pty) Ltd	
(72)	Inventor(s) KATERGARAKIS, George;THOMAS, Kyle Geoffrey	
(74)	Agent / Attorney WRAYS PTY LTD, L7 863 Hay St, Perth, WA, 6000, AU	

A dragline rope including an independent core and at least nine outer strands wound around the independent core.



DRAGLINE AND SHOVEL ROPE

Field of the Invention

[0001] The present invention relates to a dragline rope i.e. a hoist, drag or dump rope, and/or a shovel hoist or crowd and retract rope.

Background of the Invention

[0002] Dragline and shovel ropes are a very specific and specialised type of industrial rope used with excavators in mining in a variety of circumstances to pull and move heavy loads. They can take the form of dragline drag and hoist ropes, dump ropes, dragline Intermediate Boom Suspension (IBS), shovel ropes and dragline main suspension ropes. Shovel hoist and crowd and retract ropes are also included.

[0003] These types of dragline ropes are one of the most heavily used components on a dragline and are a significant expense for a mine. They are prone to fatigue and wear and commonly need replacing on mine sites.

[0004] Existing dragline ropes include a core and either 6 or 8 outer strands around the core. This leaves a significant empty space and low steel fill factor across the nominal diameter of the dragline rope due to the space between abutting strands. Due to the relatively large diameter of the outer strands in a 6 or 8 strand rope fatigue is an issue and weakness for existing draglines.

Summary of Invention

[0005] In a first embodiment, the present invention seeks to provide a dragline rope including an independent wire rope core and at least nine outer strands wound around the independent wire rope core.

[0006] Having at least nine outer strands makes the dragline rope have a larger crosssectional area, resulting in a stronger rope and reduces fatigue compared to lower numbers of outer strands due to reduced operating stresses. For a dragline rope of the same diameter with less outer strands, the at least nine strands also allows the independent wire rope core to be larger and the dragline rope more flexible. Having at least nine outer strands provides a larger contact surface area between the outer strands and the independent wire rope core reducing internal contact stresses and improved fatigue endurance.

[0007] These benefits allow the dragline rope easier to install and work with. The reduced stresses allow the dragline rope to preference spooling rather than kinking, extending the lifetime of the dragline rope.

[0008] Preferably, the independent wire rope core includes a wire main core and a plurality of core strands wound around the wire main core.

[0009] Preferably, the independent wire rope core comprises at least 6 strands.

[0010] Preferably, the independent wire rope core comprises up to 18 strands.

[0011] Preferably, the dragline rope includes wormings placed between the core and each of the outer strands.

[0012] The wormings reduce the internal contact stresses which increases the fatigue endurance of the dragline rope.

[0013] Preferably, the core is plasticated.

[0014] Preferably, the outer wires are compacted.

[0015] Compressing the outer wires increases the steel fill factor of the outer strands.

[0016] Ropes with 9 outer strands or more typically have less wires in the outer strand which increases the ropes overall resistance to crushing and deformation of the outer strand, especially in larger diameter ropes.

Brief Description of the Drawings

[0017] Notwithstanding any other embodiments that may fall within the scope of the present invention, an embodiment of the present invention will now be described, by way of example only, with reference to the accompanying figures, in which:

Figure 1 is cross sectional view of a dragline rope according to a first embodiment of the present invention;

Figure 2 is cross sectional view of a dragline rope according to a second embodiment of the present invention;

Figure 3 is cross sectional view of a dragline rope according to a third embodiment of the present invention;

Figure 4 is cross sectional view of a dragline rope according to a fourth embodiment of the present invention;

Figure 5 is cross sectional view of a dragline rope according to a fifth embodiment of the present invention; and

Figure 6 is a cross sectional view of a dragline rope according to a sixth embodiment of the present invention.

Detailed Description of the Invention

[0018] Broadly, and with reference to Figures 1 to 6, the present invention provides an excavator dragline or shovel rope including at least nine (9) outer strands and an independent core. The dragline rope of the embodiments of the present invention has a diameter of between 38mm to 180mm.

[0019] In a preferred example, the independent core is an independent wire rope core (IWRC). In alternative embodiments the core can be a synthetic or natural fibre. As an IWRC is more common, throughout the description IWRC will be used. Wherever IWRC is recited this can be taken to include alternative cores such as synthetic or natural fibres.

[0020] In one embodiment where the IWRC is an independent wire rope core, the IWRC is laid up in the opposite direction to the outer strands. This provides a low rotation lay-up.

[0021] In the following description the rope will be described as a dragline rope but will also apply to a shovel rope and a hoist rope.

[0022] Although the following embodiments with reference to the Figures recite 9 outer strands, it is within the scope of the present invention for the excavator dragline rope to include 9, 10, 11, 12, 13, 14, 15, 16 or more outer strands around the IWRC.

[0023] The use of 9 or more outer strands on a dragline rope capable of withstanding the forces a dragline rope experiences provides a higher strength than if the conventional 6 or 8 outer stand dragline ropes were used.

[0024] Additionally, as 9 or more outer strands are used in the present invention in a dragline rope of the same diameter as the conventional 6 or 8 strand dragline rope, a greater surface area contact between the outer strands and the IWRC of the dragline rope is created. This increases the fatigue endurance of the 9 or more outer strand dragline rope as internal stresses are decreased.

[0025] With the 9 or more outer strands, a greater surface contact area between the dragline rope and sheaves or drums that the dragline rope runs over is created. This spreads the forces out over a larger area and also reduces fatigue onset.

[0026] Further, using 9 or more outer strands for the same diameter dragline rope that is currently used allows the outer strands to be of smaller diameter and the core to be of larger diameter. This provides a dragline rope of increased flexibility.

[0027] The strands of the dragline rope of the present invention are made from steel or an alternative material as understood by the skilled addressee.

[0028] Referring to Figure 1, the invention according to a first embodiment is in the form of a dragline rope 11 comprising 9 outer strands 13 wound around an independent wire rope core (IWRC) 20. The outer strands 13 themselves include a plurality of outer wires 14 and inner wires 12. The outer wires 14 of the strands 13 are rounded. The IWRC 20 includes a wire main core (WMC) 18 and six core strands 17 wound around the WMC 18.

[0029] It is within the scope of the present invention for the IWRC to include from between 4 and 18 core strands, not just the six core strands 17 as illustrated Figure 1.

[0030] The IWRC 20 is plasticated around the core strands 17 and the WMC 18 to form a plastic covering 29 that defines the shape of the IWRC 20 around which the outer strands 13 are wound. Between the outer surface of the IWRC 20 and adjacent outer stands 13, wormings 15 are laid along the length of the dragline rope 11 to offer additional support and cushioning between the outer strands 13 and the IWRC 20.

[0031] In one embodiment the wormings are made of the same metal material of that the outer strands 13, core strands 17 and WMC 18 are made from.

[0032] In an alternative embodiment, the wormings include aramid fibres or other synthetic fibres as understood by the skilled addressee suitable to strengthen the dragline rope.

[0033] A second embodiment of the invention is illustrated in Figure 2. For convenience features of the second embodiment that are similar or correspond to features of the first embodiment have been referenced with the same reference numerals.

[0034] Referring to Figure 2, the invention according to a second embodiment is in the form of a dragline rope 21 comprising 9 outer strands 13 wound around an IWRC 20. The outer strands 13 themselves include a plurality of outer wires 14 and inner wires 12. The outer wires 14 of the strands 13 are rounded in the second embodiment. The IWRC 20 includes a WMC 18 and a plurality of core strands 17 wound around the WMC 18.

[0035] The IWRC 20 is plasticated around the core strands 17 and the WMC 18 to form a plastic covering 29 that defines the shape of the IWRC 20 around which the outer strands 13 are wound.

[0036] A third embodiment of the invention is illustrated in Figure 3. For convenience features of the third embodiment that are similar or correspond to features of the first and second embodiments have been referenced with the same reference numerals.

[0037] Referring to Figure 3, the invention according to a third embodiment is in the form of a dragline rope 31 comprising 9 outer strands 13 wound around core strands 17. The outer strands 13 include a plurality of outer wires 14 and inner wires 12. The outer wires 14 of the strands 13 are rounded in the third embodiment. The core strands 17 are themselves wound around WMC 18.

[0038] To minimise the stresses between outer strands 13 and core strands 17, wormings 15 are placed in the space between the core strands 17 and adjacent outer strands 13. The wormings 15 increase the strength of the dragline rope 31 and improve fatigue endurance by assisting in transferring force over a larger area.

[0039] In one embodiment the wormings are made of the same metal material of that the outer strands 13, core strands 17 and WMC 18 are made from.

[0040] In an alternative embodiment, the wormings include aramid fibres or other synthetic fibres as understood by the skilled addressee.

[0041] A fourth embodiment of the invention is illustrated in Figure 4. For convenience features of the fourth embodiment that are similar or correspond to features of the first, second and third embodiments have been referenced with the same reference numerals.

[0042] Referring to Figure 4, the invention according to a fourth embodiment is in the form of a dragline rope 41 comprising 9 outer strands 13 wound around core strands 17. The outer strands 13 include a plurality of outer wires 14 and inner wires 12. The outer wires 14 of the strands 13 are rounded in the first embodiment. The core strands 17 are themselves wound around WMC 18.

[0043] A fifth embodiment of the invention is illustrated in Figure 5. For convenience features of the fifth embodiment that are similar or correspond to features of the first, second, third and fourth have been referenced with the same reference numerals.

[0044] Referring to Figure 5, the invention according to a fifth embodiment is in the form of a dragline rope 51 comprising 9 outer strands 19 wound around core strands 17. The outer strands 19 include a plurality of outer wires 24 and inner wires 12. The outer wires 24 of the strands 19 are compacted to increase the steel fill factor of the outer strands 19 and create a smooth finish to the outer strand 19. The core strands 17 are themselves wound around WMC 18.

[0045] To minimise the stresses between outer strands 19 and core strands 17, wormings 15 are placed in the space between the core strands 17 and adjacent outer strands 19. The wormings 15 increase the strength of the dragline rope 31 and improve fatigue endurance by assisting in transferring force over a larger area.

[0046] A sixth embodiment of the invention is illustrated in Figure 6. For convenience features of the sixth embodiment that are similar or correspond to features of the first, second, third, fourth and fifth embodiments have been referenced with the same reference numerals.

[0047] Referring to Figure 6, the invention according to a fifth embodiment is in the form of a dragline rope 61 comprising 9 outer strands 19 wound around core strands 17. The outer strands 19 include a plurality of outer wires 24 and inner wires 12. The outer wires 24 of the strands 19 are compacted to increase the steel fill factor of the outer strands 19 and create a smooth finish to the outer strand 19. The core strands 17 are themselves wound around WMC 18.

[0048] The WMC 18, core strands 17 and outer strands 19 20 are all plasticated to form a plastic covering 29 that defines the shape of the dragline rope 61.

[0049] It is within the scope of the present invention to use a reverse lay inner core. This reduces the rope torque and twist.

[0050] In an alternative embodiment, the wormings include aramid fibres or other synthetic fibres as understood by the skilled addressee.

Alterations and Modifications to the Embodiments

[0051] Various additions, modifications and substitutions regarding design and construction can be made without departing from the spirit and scope of the invention.

[0052] Modifications and variations such as would be apparent to the skilled addressee are considered to fall within the scope of the present invention. The present invention is not to be limited in scope by any of the specific embodiments described herein. These embodiments are intended for the purpose of exemplification only. Functionally equivalent products, formulations and methods are clearly within the scope of the invention as described herein.

[0053] Reference to positional descriptions, such as lower and upper, are to be taken in context of the embodiments depicted in the figures, and are not to be taken as limiting the invention to the literal interpretation of the term but rather as would be understood by the skilled addressee.

[0054] Throughout this specification, unless the context requires otherwise, the word *"comprise"* or variations such as *"comprises"* or *"comprising"*, will be understood to imply the inclusion of a stated integer or group of integers but not the exclusion of any other integer or group of integers.

CLAIMS:

1. A dragline rope including an independent core and at least nine outer strands wound around the independent core.

2. The dragline rope as claimed in Claim 1, wherein the core is an independent wire rope core laid up in the opposite lay direction to the outer strands.

3. The dragline rope as claimed in Claim 1 and Claim 2, wherein the whole rope is plasticated.

4. The dragline rope as claimed in any one of Claims 1 to 3, including wormings placed between the independent core strands and each of the outer strands.

5. The dragline rope as claimed in any one of Claims 1, 2, 3 or 4, wherein the core is plasticated.



1/6















61