A rope forming machine in which consecutively installed between a reel holding a core of fibrous material and a rotor circumferentially mounting a plurality of wire reels for holding the outer strands of the rope is a spring forming mechanism for forming wire into a cylindrical spring which is used to surround the core brought off the core-holding reel and a device for determining the extent of tensioning of the cylindrical spring with the core enclosed therein after emerging from the spring forming mechanism. The rotational speed of the rotor and a drawing-off drum for drawing off the finished rope formed by twisting the strand around the formed cylindrical spring are controlled, to correlate the rate or rope twisting and that of cylindrical spring forming.
ROPE-TWISTING MACHINE

BACKGROUND OF THE INVENTION

The present invention relates to the steel-wire rope-making industry and more particularly to rope-twisting machines of a basket type.

Rope-twisting machines of a basket type, are well known in the art. In these machine provision is made for a reel wound up with a fibrous core of an organic material and a rotor consecutively installed after the reel and having circumferentially disposed reels wound up with strands each consisting of steel wires twisted together.

This rotor is fixed on a hollow shaft connected to a drive for rotation thereof.

The rotor shaft is hollow so that the core pay pass through it to a position where strands are wound around it.

Installed after the rotor is a device for squeezing the rope after it has been twisted from strands and a drawing-off drum, both of which are kinematically linked with the drive.

The rope-twisting machines known in the art are capable of producing steel-wire ropes consisting of strands of steel wires twisted together and a core of fibrous material.

Ropes are known in which the core is actually a helical spring tube filled with lubricating material. This tube is encircled with strands of wires twisted together.

These ropes are produced in several stages separated in time and space. First, a helical spring tube is formed by equipment for coiling springs and the tube is filled with lubricating material. Then, a rope-twisting machine is used to wind strands around this core.

SUMMARY OF THE INVENTION

The object of the present invention is to provide a rope-twisting machine capable of producing ropes consisting of wire strands laid in around the core of fibrous materials with the core being surrounded with a cylindrical spring formed by a coiled wire.

This and other objects are achieved due to the provision of a basket-type rope-twisting machine comprising consecutively installed a reel holding fibrous core, a rotor with strand-holding reels positioned along the circumference thereof and installed on a drive-connected hollow shaft for permitting passage the core in the course of its progressive motion, and a drawing-off drum kinematically linked with the drive of the rotor shaft for effecting the progressive motion of twisted strands and core wherein, according to the invention consecutively installed between the fibrous core holding reel and the rotor is a mechanism for forming the positively delivered wire into a cylindrical spiral spring surrounding the core, and a device for following up the extent of tensioning the cylindrical spring with the core in the course of their progressive motion after emerging from the spring forming mechanism and to control the rotational speed of the rotor and the drawing-off drum so as to correlate the rate of rope twisting and forming the cylindrical spring.

Preferably the spring forming mechanism comprises a wire holding reel freely mounted on the hollow shaft on which a drive-connected drum is fixed to direct the wire to the rollers kinematically linked with the drive for positive delivery of the wire towards the rollers the idlers form the wire into a spiral and are positioned so that a spring spiral formed by them from the wire is located against the hollow of the shaft.

This embodiment of the cylindrical spring forming mechanism of simple design and reliable in operation.

The rope-twisting machine according to the present invention is capable of producing ropes the cores of which are encompassed by a cylindrical spiral spring protecting the core from being crushed by the strands, assures high operating properties of the ropes and consequently prolongs their service life.

BRIEF DESCRIPTION OF THE DRAWINGS

a specific embodiment of the present invention will now be described in detail with reference to the accompanying drawings, in which:

FIG. 1 is a side elevational view of the rope-twisting machine according to the invention;

FIG. 2 is an enlarged cross-sectional view taken along the line II—II of FIG. 1:

FIG. 3 is a side elevational view of the device for following-up the extent of tensioning the cylindrical spring encompassing the core.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

The rope-twisting machine of the invention includes a reel 1 (FIG. 1), wound with core 2 to form the rope 3.

The core 2 is a fibrous material such as hemp, abaca, sisal. Installed after the reel 1 in the direction of operation of the machine is a mechanism 4, for forming a cylindrical spring 5 for encountering the core 2. Following the mechanism 4 is a device 6 for following up the extent of tensioning the cylindrical spring 5 after it emerges from the mechanism 4.

Consecutively installed after the device 6 is a rotor 7, a drawing-off drum 8 and receiving drum 9.

The device 4 for forming the cylindrical spring 5 incorporates a reel 10 wound with wire 11 from which the spring 5 is formed.

The reel 10 is mounted on a hollow shaft 12 positioned on supports 13 and 14.

Mounted on the same shaft is a drum 15 which directs the wire 11 to rollers 16 for positive delivery of the wire 11 to rollers 17 which form the wire into a spiral.

For the purpose of synchronous rotation the rollers 16 are inclosed in a cage which is not shown in the drawing for more clarity.

The drum 15 is connected to a gear reduction unit 18 through a carrier 19 thereby to receive rotation.

The gear reduction unit 18 comprises gears 20 and 21. The gear 20 is connected to an electric motor 24 via a shaft 22 and a coupling 23.

The shaft 22 carries a gear 25 which via a reduction unit 26 couples the rollers 16 to the electric motor 24.

The reduction unit 26 comprises gears 27 and 28 fixed on a shaft 29, the gears 30 and 31 mounted on a shaft 32.

Gears 28 and 30 are interconnected through the medium of the gears 33 and 34.

The gear 31 meshes with a gear 35 fixed on the shaft 36 which is connected to the rollers 16 to cause rotation thereof.
To permit free passage of the shaft 36 through the gear 21 to one of the rollers 16 the gear 21 has a hole which houses a bearing (not shown).

The shaft 32 is hollow, while the gear 21 has a centrally located hole 37 to pass the core 2 into the hollow shaft 12.

Gears 28, 30, 33 and 34 are replaceable to obtain the required pitch and consequently the speed required to coil the cylindrical spring 5 depending on the diameter of the rope 3 being produced, diameter of the wire 11 and the chosen clearance between the turns of the spiral spring 5.

Rollers 17 which form a spiral from the wire 11 are installed on the gear 21 circumferentially around the hole 37 (FIG. 2). The hollow shaft 12 is connected to a worm gearing 38 for extending the shaft 12 so as to replace the ree 10 when empty with a new one.

The device 6 which determines the extent to which the cylindrical spring 5 surrounding the core 2 has been tensioned in the course of the progressive motion of the core and spring after emerging from the mechanism 4, comprises stationary rollers 39 (FIG. 3) and a roller 41 installed for possible reciprocating motion in the vertical direction.

Rollers 39 and 40 are so positioned that the spring 5 rests on them from below, while on the roller 41 it rests from above.

To provide reciprocating motion, the roller 41 is fixed on the end of a rod 42 and is biased by a spring 43.

The other end of the rod 42 is connected to the doubled jaw coupling 44 of a regulator 45 to correlate the rotational speed of the rotor 7 and that of the drawing-off drum 8 with the rate of forming the cylindrical spring 5.

The jaw coupling 44 is fitted onto a shaft 46 the ends of which mount bevel gears 47 and 48 having freedom of rotation and meshing a gear 49. The gear 49 is fixed on a shaft 50, having two sections a and b which are spirally threaded in opposite directions. These sections carry nuts 51 and 52 connected to levers 53 and 54 having turning axes 55 and 56.

Levers 53 and 54 are connected to tapered disks 57 and 58 installed on a driven shaft 59 and to tapered disks 60 and 61 installed on a driven shaft 62, whereas a continuous belt 63 is placed between the tapered disks 57, 58 and tapered disks 60, 61.

The shaft 50 is prevented from longitudinal displacement by means of a stop 64, and the rotor 7 (FIG. 1) has a hollow shaft 65 which carries round disks 66 interconnected by means of frames 67. Installed on the frames 67 are reels 68 wound with strands for the rope 3. The reels 68 are free to rotate around their axes.

The shaft 65 carries a gear 69 which meshes with another gear 70 fixed on a shaft 71 (FIG. 3) which by means of a coupling 72 is connected to the driven shaft 59 of the regulator 45.

The driving shaft 62 of the regulator 45 is connected to an electric motor 74 through a coupling 73 (FIG. 1).

Installed eccentrically with respect to the shaft 65 is a disk 75 connected to the frame 67 by cams 76 and intended for turning off these frames.

Mounted on the end of the shaft 65 on the side of the drawing-off drum is a die 77 having holes for passage of the strands of the rope 3. The die 77 is designed for twisting the strands around the cylindrical spring 5 with the inner core 2 passing through the hollow shaft 65.

The shaft 65 is mounted on supports 78 and 79.

Positioned ahead of the die 77 and in close proximity thereto are jaws 80 for setting the rope 3 after it has been twisted.

The drawing-off drum 8 is connected to the shaft 65 by means of a reduction unit 81 and to the receiving drum 9 by means of a chain drive.

The rope-twisting machine described above is prepared for operation as follows.

The reel 1 wound with the core 2 is installed on supports 83. The reel 10 wound with wire 11 is installed on the hollow shaft 12, for which purpose the shaft 12 is extended with the help of the worm gearing 38 and after installing the reel 10 is retracted to the initial position. The core 2 is moved to the zone of formation of the cylindrical spring 5, i.e. to the rollers 17, and the wire 11 is also brought to the same zone.

The electric motor 24 is then switched on to commence formation of the cylindrical spring 5 which surrounds the core 2. The spring 5 draws the core off the reel 1. The cylindrical spring is produced until its length somewhat exceeds the distance from the forming zone to the drawing-off drum 8. The cylindrical spring 5 is then inserted into the device 6 and pushed through the hollow shaft 65.

Reels 68 are now installed in the frames 67 and strands wound on them are pushed through the die 77 and the jaws 78, thereafter the strands together with the cylindrical spring 5 and the enclosed core 2 are attached to the drawing-off drum 8. Thus, the rope-twisting machine is ready for operation.

Electric motors 24 and 74 are the switched on. Torque from the motor 24 via the reduction unit 18 and the carrier 19 is transmitted to the drum 15. Simultaneously a proportion of torque via the reduction unit 26 is transmitted to the delivering rollers 16.

The drum 15 commences rotation to-gethether with the rollers 16 and 17. In addition, the rollers 16 being rotated by the drive 26 positively deliver the wire 11 to the rollers 17 which form the spiral of the cylindrical spring 5 to surround the core 2.

The cylindrical spring 5 when passing through the device 6 rolls on the reels 39, 40 and 41. When the tension of the cylindrical spring 5 exceeds a given value, the spring presses on the roller 41 which lowers to compress the spring 43. The rod 42 lowers to engage the coupling 44 with the gear 47. As the shaft 46 mounts the bevel gear 48 meshing another bevel gear 85 the shaft 50 starts rotating in the direction indicated by an arrow A as shown in FIG. 3.

Because the sections a and b are threaded in opposite directions the nuts 51 and 52 with the shaft 50 rotating, are brought closer to each other.

Thus the disks 57 and 58 move closer to each other while the disks 60 and 61 move apart. As a result the transmission ratio between the shaft 59 and 62 is increased thus reducing the rotational speed of the rotor 7 and the drawing-off drum 8. In this way the rate of forming the cylindrical spring 5 is correlated with the rate at which the rope 3 is being twisted.

With the tension of the cylindrical spring 5 reduced the roller 41 due to the action of the spring 43 is raised and thus through rod 42 disengages the coupling 44 from the gear 47. When the tension of the cylindrical spring 5 is further reduced the roller 41 with the rod 42 is raised still higher to engage the coupling 44 to the
The remaining components of the regulator operate in reverse to the above described regulating procedure.

Torque from the electric motor 74 via the coupling 73, reduction unit 45 and gears 70 and 69 is transmitted to the hollow shaft 65 and from the latter to the drawing-off drum 8 and via the chain drive 82 to the receiving drum 8.

With the rotor 7 rotating, strands wound off the reels 68 and move into the die 77 and due to the rotation of the rotor 7 are twisted around the cylindrical spring 5 surrounding the core 2.

The twisted rope 3 is pressure-set when passing through the jaws 80 and after making several turns around the drawing-off drum 8 to prevent slipping of the rope on the drawing-off drum 8 reaches the receiving drum 9.

A rope-twisting machine constructed according to the present invention has been in actual operation for a about a year and has proved dependable in service.

Ropes made using the machine of the instant invention, possess high operational characteristics and in the iron-ore industry they serve twice as long in comparison having only a ropes with fibrous core.

What we claim is:

1. A basket type rope-twisting machine for forming a continuous length of rope, comprising: a reel for holding a fibrous core; rotatable-forming means for forming a reel of wire into a continuous cylindrical spring which is used to compressively surround the core delivered thereto from said reel; first driving means for rotatably driving said rotatable forming means during formation of said cylindrical spring; a device operatively associated with said rotatable forming means for determining the extent of tensioning the formed cylindrical spring with the core enclosed therein; a rotor having a plurality of circumferentially positioned wire-holding reels for providing an equal plurality of wire strands; a shaft for mounting said rotor and being hollow to allow passage therethrough of said cylindrical spring together with the core enclosed therein; second driving means for rotating said shaft whereby said wire strands are wrapped around the cylindrical spring with the inner core, emerging from said hollow shaft after passage therethrough, to form the continuous length of rope; a drawing-off drum for imparting progressive motion to the thus formed rope and being kinematically coupled with said second driving means; a receiving drum for winding the formed rope, and being kinematically coupled with said second driving means, said device for determining the extent of tensioning said cylindrical spring with the core being kinematically coupled with said second driving means to control the rotational speed of said rotor and said drawing-off drum thereby to correlate the rate of rope wrapping by said strands with that of forming said cylindrical spring.

2. A rope-twisting machine as set forth in claim 1, wherein said rotatable forming means comprises a wire holding reel freely mounted on a hollow shaft having a drive-connected drum, said drive connected drum directing the wire to a first set of rollers kinematically linked with said first driving means drive for positive delivery of the wire therefrom to a second set of rollers for commencing spiral formation of the wire so that the spiral formed thereby is located adjacent the hollow of said shaft.

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