



# UNITED STATES PATENT OFFICE

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## APPARATUS FOR LOCKING TUBULAR MEMBERS ON SHAFTS

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This invention relates to apparatus for locking tubular members on shafts, and more particularly to an apparatus for locking a cop tube on a cop winding machine shaft for rotation therewith.

In the textile insulating field, such as braiding, serving, and the like, a filamentary textile thread is drawn from a supply cop and applied around a continuously advancing conductor in accordance with the particular type of insulating machine involved. The particular supply cop involved usually consists of a predetermined amount of textile thread wound in a predetermined manner on a tubular core made generally of fiber, paper, or the like. It is the general practice in the industry to wind a cop of textile thread from a large supply package on a suitable cop winding machine so that a tightly wound cop of predetermined size may be obtained for use with a particular insulating machine. Since the tubular core on which the textile thread is wound is used only as a means of holding the thread during the insulating operation, it is very desirable to use the tubular cores over and over again.

In winding the textile thread from the large supply package on the tubular core to obtain a cop of predetermined size, it is necessary to rotate the core. To obtain this rotation of the core, it has been the practice in the past to provide a relatively tight fit between the tube and the rotating shaft of the cop winding machine. In this way the rotation of the shaft is imparted to the cop tube by the frictional engagement between the tubular core and the shaft. However, it has been found that when a paper core tube is pressed on the winding shaft and a textile cop wound thereon, there occurs a certain amount of slippage between the tube and the shaft which serves to slightly enlarge the internal diameter of the tube and render it unfit for further service. This means that the tube would have to be discarded after the cop had been used up in a particular insulating operation, which obviously proves to be a rather costly procedure.

In order to overcome the disadvantages of the smooth winding shaft, it is obviously necessary to provide some means on the shaft for locking the tube for positive rotation therewith and yet render the tube readily removable from the shaft when desired. In addition, the device must be such that the tube may be used repeatedly a substantial number of times without injury to the tube.

An object of the invention is to provide new

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and improved apparatus for locking a tubular member on a shaft.

Another object of the invention is to provide a new and improved apparatus which automatically locks a tubular member on a shaft upon the rotation of the shaft in one direction and which quickly releases the tube from the shaft upon a slight turn of the tubular member in the same direction when the shaft is not rotating.

An apparatus embodying certain features of the invention comprises a shaft of a cop winding machine which is provided with a plurality of longitudinal grooves along its periphery. A plurality of rollers are positioned in tandem in each of the grooves, and a tubular retainer is positioned over the shaft having longitudinal tapered slots therein for receiving a portion of the rollers extending beyond the periphery of the shaft. Normally the periphery of the rollers is slightly below the periphery of the retainer so that a tube on which a textile cop is to be wound may be slidably positioned on the retainer. When the shaft is rotated in a given direction, the grooves are designed to cam the rollers outwardly beyond the periphery of the tube, in which case they lock the tube on the shaft for rotation therewith. When the cop winding operation on the tube is completed, the cop and tube may be readily released from the shaft by a slight rotation of the cop and tube in the same direction.

Other objects and advantages of the invention will be apparent from the following detailed description of the specific embodiment thereof, when read in conjunction with the appended drawing, in which:

Fig. 1 is a longitudinal view of a spindle of a cop winding machine showing certain features of the present invention and having portions thereof broken for reasons of clarity, and

Fig. 2 is an enlarged, sectional view taken along line 2-2 of Fig. 1.

Referring now to the drawing, and particularly to Fig. 1, a shaft 10 is rotatably mounted in a support 11 of a suitable cop winding machine and is adapted to be driven at a high rate of speed by a suitable drive mechanism (not shown) associated with the machine. A set collar 12 is provided on the shaft 10 adjacent to the support 11 in order to properly position the shaft with respect to the support 11. The free end of the shaft 10 is provided with three, equally spaced, longitudinal grooves 13-13 (Fig. 2), which extend along the periphery thereof from the right end of the shaft and terminate at arcuate shoulder-

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ders 14—14, adjacent to the set collar 12. Each of the grooves 13—13 is provided with a concave bottom 15 extending from the periphery of the shaft 10 to a radial shoulder 16. As the bottom 15 of the groove proceeds from the periphery of the shaft to the shoulder 16, it moves closer and closer toward the center of the shaft so that its juncture point with the radial shoulder 16 is nearer the center of the shaft than any other point along the bottom 15.

Four hardened steel rollers 17—17 are positioned in tandem in each of the grooves 13—13 and are maintained in the groove by a tubular retainer 20 which is slidably positioned on the shaft 10. The retainer 20 is provided with a plurality of elongated, tapered slots 21—21 arranged to be complementary with the longitudinal grooves 13—13 and are of such length that each slot 21 embraces only two of the four rollers 17—17 positioned in the related groove. The rollers 17—17 are of such size that when they assume their normal positions in the grooves 13—13, that is, against the shoulder 16, a substantial portion of each roller extends beyond the periphery of the shaft. The portion of the rollers 17—17 extending beyond the periphery of the shaft 10 extends into the tapered slots 21—21 provided in the retainer 20.

The retainer 20 is designed to have a sliding fit with respect to the shaft 10 and is of such thickness that when the rollers 17—17 are resting against the radial shoulders 16—16 of their respective grooves 13—13, the periphery of the rollers 17—17 is slightly below the external diameter of the retainer 20. The slots 21—21 are tapered whereby the inner opening thereof provides sufficient operating clearance for the rollers 17—17 while the outer opening of the slots is smaller than the diameter of the rollers so that the rollers are prevented from falling through the slots. The periphery of the retainer 20 is highly polished and plated to provide a smooth sliding fit for a cop tube, such as a tube 23 made of paper, fiber, or the like, on which a textile thread may be wound to form a cop 24; the outline of which is indicated in broken lines on the drawing.

When the shaft 10 is stationary and the tube 23 is positioned on the retainer 20 preparatory to winding the cop 24 thereon, the rollers 17—17 rest against their respective shoulders 16—16 and are, therefore, not in engagement with the inner surface of the tube 23. However, when the shaft 10 is rotated in a clockwise direction, when viewed in Fig. 2, such rotation thereof causes the rollers to ride away from their respective shoulders 16—16. In so doing, the concave bottom 15 of the grooves 13—13 cams the rollers 17—17 outwardly away from the center of the shaft 10 causing a portion of their peripheries to project through the slots 21—21 provided in the retainer 20 and engage the inner surface of the tube 23. Thus, the rotation of the shaft wedges the rollers between the bottom of their respective grooves and the inner surface of the tube thereby locking the tube to the shaft so that thereafter the tube rotates with the shaft. Relative movement is provided between the retainer 20 and the shaft 10 so that when the shaft is rotated the rollers can roll along the bottom 15 and project through the slots 21—21 to lock the tube 23 on the shaft.

Since the textile thread being wound on the tube 23 is under substantial tension, the shaft 10 must exert sufficient torque on the tube to overcome this tension and maintain the winding operation of the cop 24 at a given speed. The

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tension supplied to the threads being wound on the tube 23 tends to roll the rollers 17—17 further away from the shoulder 16 whereby they are more forcibly wedged between the bottom 15 of the groove 13 and the inner surface of the tube 23. In this way, the tension exerted on the threads being wound on the tube 23 causes the tube to be more tightly gripped through the camming action of the grooves 13—13 and their respective rollers 17—17 so that a positive, non-slip drive is provided between the shaft and the cop tube.

A plurality of rollers 17—17 are provided in each groove so that each of the rollers may be cammed outwardly independently of each other, which feature compensates for any irregularities which may be present in the internal diameter of the tube 23. The inner surface of the retainer 20 and the periphery of the shaft 10 including the surface of the grooves 13—13 are surface-hardened to prevent undue wear of the moving parts and thereby substantially lengthening the life of the shaft. Since the surface of the rollers 17—17 are smooth, their engagement with the inner surface of the tube 23 does not damage the inner surface thereof, in which case the tube 23 may be used repeatedly for winding the textile thread thereon to form a textile cop 24.

When the cop 24 has reached a predetermined size, the winding of the threads on the tube 23 is terminated and the rotation of the shaft 10 ceases. When rotation of the shaft 10 has terminated, it is a relatively simple matter to remove the cop and tube from the shaft 10 by simply turning the cop 24 and the tube 23 in their winding direction which causes the rollers to move into the deeper portion of their respective grooves and engage their respective shoulders 16—16. When the rollers are in this position, they no longer engage the tube 23 and the tube and cop may be readily withdrawn from the retainer 20.

The above-described apparatus provides for an automatic locking of a cop tube, such as the tube 23, on the shaft 10 for rotation therewith and for a quick and simple release of the tube 23 when rotation of the shaft 10 terminates. The automatic locking and quickly effected release features of the above-described apparatus eliminates entirely the use of various types of lock nuts, expansion rings, and the like, employed generally to lock such a cop tube to a shaft or spindle to obtain positive rotation therewith.

While the tube 23, on which the cop 24 is to be wound, has been designated as being made of fiber or paper, which is the general practice in the textile insulating art, it is believed to be obvious that the tube 23 may be made of any metallic material or plastic material, if desired, without impairing effectiveness of the camming action of the rollers 17—17 upon rotation of the shaft 10. The rollers 17—17 will grip satisfactorily a metallic or a plastic surface and provide a positive, non-slip drive between the shaft and a cop tube made of such materials.

While the above-described apparatus is particularly well adapted to automatically lock a cylindrical tube on a winding shaft for rotation therewith, it may be readily adapted to lock various types of spools and reels to their respective driving shafts and to likewise provide a quickly effected release of such spools and reels from their respective driving shafts without departing from the spirit and scope of the invention as defined in the appended claims.

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What is claimed is:

1. An apparatus for winding filamentary articles from a supply thereof on cop tubes, which comprises a shaft for rotating the cop tube and having a plurality of longitudinal grooves provided in one end thereof, a plurality of elongated rollers positioned in tandem in each of the longitudinal grooves, and a tubular member slidably positioned on the shaft for retaining the rollers in the grooves and having a plurality of slots for receiving portions of the rollers so that the rollers may abut each other and are freely movable independently of each other, said grooves being provided with portions of such depth that when the rollers are positioned in such portions the rollers extend beyond the periphery of the shaft but not beyond the periphery of the tubular member so that a cop tube may be slidably positioned over the tubular member, the bottom of said grooves being shaped to cam the rollers outwardly beyond the periphery of the tubular member, whereby when the shaft is rotated in its winding direction the rollers are cammed outwardly until they are wedged firmly between the bottom of the grooves and the inner surface of the cop tube and thereby lock the cop tube to the rotating shaft.

2. An apparatus for winding filamentary articles from a supply thereof on cop tubes, which comprises a rotatable shaft having a plurality of longitudinal grooves provided along the periphery thereof, the bottom of said grooves having a concave contour extending from the periphery of the shaft to a radial shoulder provided at right angles thereto, a plurality of elongated rollers positioned in tandem in each of said grooves, each

of said rollers being of such size that when they are positioned against the radial shoulders of their respective grooves a substantial portion thereof extends beyond the periphery of the shaft, and a tubular member slidably positioned over the shaft and having a plurality of longitudinal slots with tapered sides for receiving the extending portion of the said rollers so that the rollers may abut each other and are freely movable independently of each other, said tubular member being of such diameter that when the rollers are positioned against the radial shoulders of said grooves they do not extend beyond the periphery of the tubular member so that a cop tube on which the filamentary article is to be wound may be slidably positioned thereon, whereby when the shaft is rotated in its winding direction each of said rollers is cammed outwardly independently of the other by the concave bottom of its respective groove until they project through the slots of said retainer and lock the cop tube to the shaft for rotation therewith.

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