Feb. 17, 1942. E. L. PERRY 2,273,373

TEXTILE WINDING CORE

Filed Aug. 14, 1940

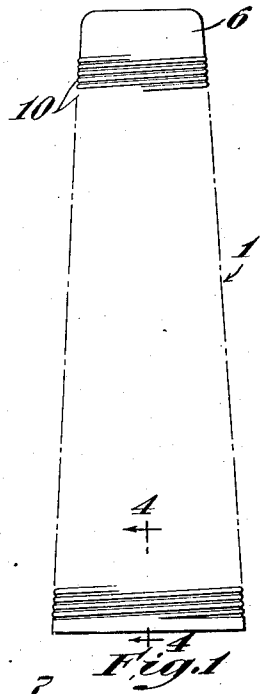



Fig. 1

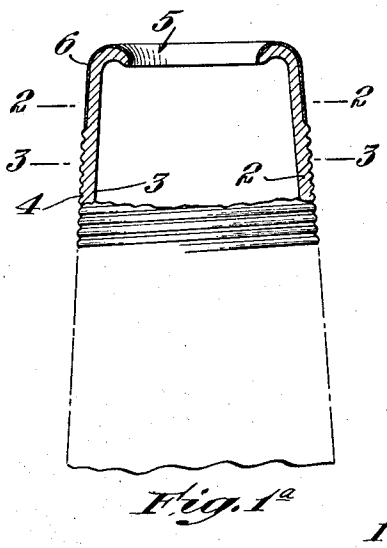



Fig. 1a

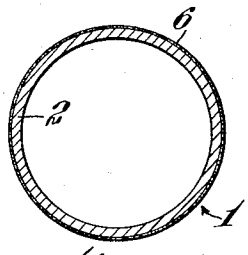



Fig. 2

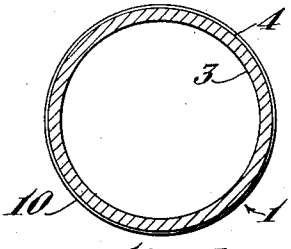



Fig. 3

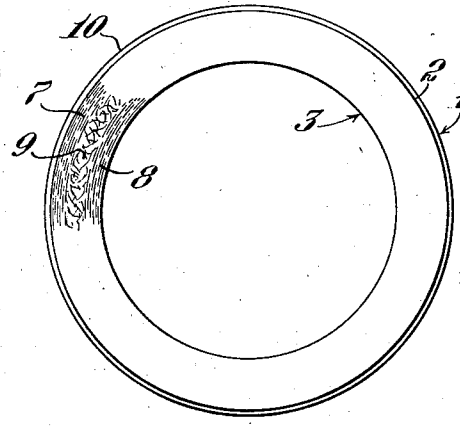



Fig. 3a

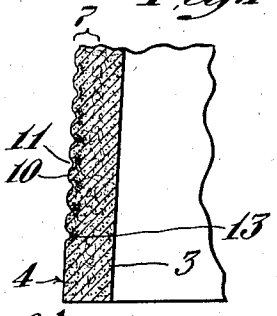



Fig. 4

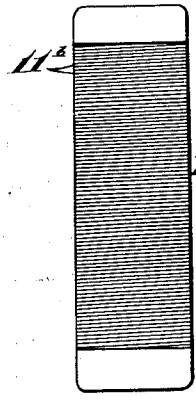



Fig. 6

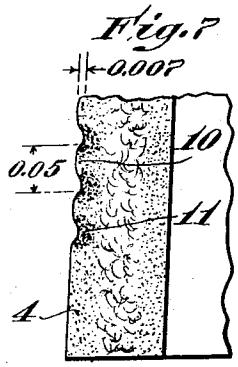



Fig. 7

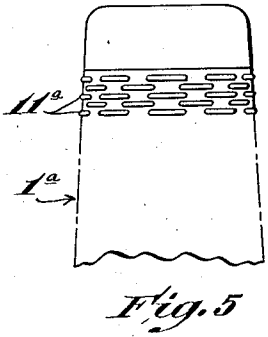



Fig. 5

Inventor
Eugene L. Perry
by Roberts Cushman & Woodbury
Att'ys.

Patented Feb. 17, 1942 2,273,373

# UNITED STATES PATENT OFFICE

2,273,373

## TEXTILE WINDING CORE

Eugene L. Perry, Bloomfield, N. J., assignor to Universal Winding Company, Cranston, R. I., a corporation of Massachusetts

Application August 14, 1940, Serial No. 352,600

16 Claims. (Cl. 242—122)

This invention pertains to hollow articles formed predominantly of fibrous material, and relates more particularly to textile winding cores, although in its broader aspects the invention is of more general utility. In the textile industry yarn or thread is wound upon such a core to form a mass, package or cheese, and it is common to subject the yarn or thread, so wound upon the core, to such treatments as steaming, dyeing, drying, etc. Thus during its intended useful life, the core is subjected to the heavy compressive stress imposed in winding the yarn under tension upon it; to repeated handlings during which it must hold the heavy yarn mass firmly and must not collapse or shrink (which would allow the yarn mass to break down or slip off); its projecting ends are exposed to blows or other mechanical injuries and to the weight of superposed packages during shipment or storage; its tip is exposed to the highly abrasive action of the yarn being unwound therefrom; and when the package is subjected to treatment by steam, liquids or to drying atmosphere the core is exposed to the softening, disintegrating and warping effects of such reagents.

For acceptability to the trade the core must be light in weight, uniform in wall thickness and of standard size, and it must be strong and stiff enough to withstand the various stresses to which it is subjected during use, at least for a reasonable period of service; it should have an inner surface which is smooth and of accurate curvature to ensure its proper fitting to the mandrel or arbor of the winding or unwinding machine; and its outer surface should be of a character such as reliably to retain the yarn mass. This latter feature is of particular importance when dealing with the stiff and wiry synthetic yarns such, for example, as rayon.

The uniformity of wall thickness and truly circular contour of the core is of great importance in attaining proper balance, and true balance is an essential to acceptability to the trade. When fine threads are wound onto or unwound from a core at high speed, even a slight wobble imparts a jerk or vibration to the filament and this repeated snap frequently results in yarn breakage. Since the reduction in yarn breakage is of the utmost importance to the textile manufacturer, various expedients have been resorted to in attempting to balance such textile cores as previously made. For example, it has been proposed to grind the surface of the core, or, when the core is made by winding paper about a mandrel, to ensure balance by carefully matching the superimposed layers of paper. It has also been proposed to insert or attach minute metallic weights to the core at the proper places as determined by a balancing operation, thereby to ensure proper balance. Obviously, however, all of these expedients are expensive and add unduly to the cost of production even if successful.

Such cores have previously been made in accordance with various methods, sometimes from sheet metal alone, or from wood turned in a lathe, but by far the greater part of such cores are made from paper or some other paper-like or organic sheet material, since such materials are cheap and provide cores which are reasonably light in weight.

It has been proposed heretofore to prepare such cores by a simple moulding operation from a plastic material, but such prior moulded cores, without reinforcement, cannot be depended upon to stand up under the conditions of use, except they be made with walls of such thickness that they become unduly heavy and cumbersome. Even such abnormally thick-walled cores will not withstand the action of such reagents as steam or liquids for any appreciable time without swelling and disintegrating. In the past, cores have sometimes been made of a relatively soft pulp material with reinforcements of metal or other hard substance at such portions of the core as are most subject to wear. This, however, is undesirable both from a cost standpoint and from that of durability since the reinforcing material tends to loosen from the body of the core during use.

It has also been proposed (and very widely practiced) to make such a core from a strong, hard, sheet material, such as kraft paper, thin cardboard or the like, wound in a spiral about a mandrel, the several convolute turns of the spiral being united by means of adhesive. When the core so made is of conical form, the tip or small end is usually finished to make it smooth, for example by the application of lacquer or a metal cap. While cores made by winding a sheet of paper or the like are quite strong and stiff without being unduly heavy and thick, this mode of manufacture has the disadvantage that it is wasteful of material since the core, if conical, cannot be wound from straight-edged sheets but must be wound from sheets cut to the arc of a circle; the core so constructed is unbalanced unless, in winding, a degree of care, impractical as a commercial procedure, be employed, and even then further steps of balancing are necessary to

make the core acceptable; the finishing of the tip is difficult by reason of the arrangement of the spiral layers at the tip, and after finishing, by usual methods, the tip tends to become distorted during use, particularly when subjected to moisture; the inner surface of such a core is not smooth, by reason of the lap of the first layer over the next so that the core does not fit snugly over a mandrel of truly circular form, with resultant difficulties in winding; the outer surface also has a lap at the point where the last winding terminates, thus requiring that, for an outer surface of circular contour in transverse section, the core must be subjected to such an operation as grinding; and although the grinding operation may result in the formation of a velvet or nap surface, sometimes regarded as useful in retaining the yarn in place, such a nap surface is not altogether to be depended upon to retain such wiry and slippery materials as rayon.

Among the objects of the present invention are to provide a core, in particular a conical or elongate truncated conical core consisting predominantly of fibrous material which is seamless, substantially perfectly balanced about its longitudinal axis, having a smooth inner surface with a uniform wall thickness and which is circular at all cross sections; which is strong and stiff enough to withstand all of the usage and treatment to which it may be subjected during a normal period of life as a support for a yarn mass; to provide a core which is capable of withstanding the action of dilute acids or alkalies, ordinary dyeing reagents or a drying atmosphere without rapid deterioration or warping; to provide a core which may have a thread-retaining surface of such a character as to provide tension relief and air space beneath the inner layer of yarn; to provide a core which is light in weight and cheap to construct; to provide a core having a smooth, hard and preferably polished integral tip, or which is of such construction as to facilitate the application thereto of a premoulded finish cap, the tip finish being permanent and providing the smoothness and wear resistance essential to a core which is to be used for unwinding yarn over its end.

While the present invention is also of utility as respects cores of cylindrical type, it is particularly advantageous, as respects its more specific features, in its embodiment in a core of tapered form such as is commonly known in the trade as a "cone," and in the further more detailed description and in the claims the improved article may be referred to as a cone for convenience in description but without limiting intent. Moreover, as respects its broader aspects the invention is not necessarily limited even to its embodiment in a textile winding core but may find application in the production of any hollow article whose section, taken at right angles to the principal axis, is bounded by two concentric circles, and especially to articles having tapered sides but without reentrant angles.

Other and further objects of the invention will be pointed out hereinafter in the following more detailed description and by reference to the accompanying drawing, in which—

Fig. 1 is a side elevation of a completed textile cone illustrating one embodiment of the present invention;

Fig. 1ª is a fragmentary diametrical section of the cone shown in Fig. 1, but to larger scale;

Fig. 2 is a section on the line 2—2 of Fig. 1ª;

Fig. 3 is a section on the line 3—3 of Fig. 1ª;

Fig. 3ª is an enlarged section, on the same plane as Fig. 3, illustrative of the internal construction of the wall of the core;

Fig. 4 is a section on the line 4—4 of Fig. 1, to enlarged scale, illustrating the internal structure and the yarn-retaining ribs;

Fig. 5 is a fragmentary side elevation similar to Fig. 1, but showing a slight modification;

Fig. 6 is a diagrammatic side elevation showing the invention as embodied in a core of cylindrical form; and

Fig. 7 is a diagrammatic diametrical section illustrative of appropriate dimensions for the yarn-retaining ribs.

Referring to the drawing, the numeral 1 designates a textile winding core embodying the invention, such core being shown as of elongate, truncated conical shape. Cores of this general shape are commonly employed in the textile industry for supporting yarn packages or masses, particularly when it is desired, as in the knitting industry, to draw off the yarn endwise over the tip of the core, the tapered construction facilitating such unwinding operation.

This core has walls 2 (Fig. 1ª) predominantly of fibrous material, for example paper stock, preferably having its constituent fibers bonded by means of a colloidal substance which is irreversible in phase so that when the core has once been given its final shape, dimensions and finish, it will not soften, shrink or break down if subjected to heat, moisture or the like. Among the substances useful as bonding agents and in imparting the desired characteristics are some of the synthetic resins, although it is contemplated that reasonably good results may be secured by the use of other bonding materials, for instance, chromated glue or the like. However, as already noted, the bonding substance employed should be one which, after completion of the core, is not substantially affected by moisture or by any of the other conditions such as heat, subjection to mild alkalies or acids, or even to dye liquors, which are at times used as reagents in treating yarn wound upon such cores.

The core shown in Figs. 1 and 2 is, as noted, a tapering core, being smaller at its upper end than at its lower end. The upper end is, as usual, finished by turning the end portions of its wall inwardly (Fig. 1ª), leaving an opening 5 at its top which, with the inturned edge, provides convenient means whereby the textile operator may, by inserting the finger in the opening, pick up the core with its mass of yarn and without touching or disturbing the wound mass. The tip or small end of the cone is preferably provided with a distinctive finish different from that of the body of the cone. Such distinctive finish may be of any desired kind or character, for example it may be merely a special surface texture or the like resulting from appropriate treatment of the material of the cone at its tip portion or it may be the result of the application of a separately formed cap of a suitable material. For instance the small end of the cone itself may be given a high polish and be rendered firm, dense and smooth, as compared with the surface of the cone body. To this end, the small end or tip of the cone may be subjected to pressure by the use of properly configured formers and if a high polish be desired, the tip of the cone may further be subjected to the action of a heated burnishing implement which rotates relatively to the core. Such high polish may be enhanced by incorporating into the material from which the cone is

formed or by the application to the surface of substances such as low melting resins, waxes or the like. On the other hand, as illustrated in Fig. 1[a], the tip or small end of the cone may be provided with a preformed tough but thin-walled finish cap 6 designed to provide a polished working surface of a character suitable for use with fine or easily damaged threads or filaments, such separately formed cap being more fully described and claimed in the copending application of Bates et al., Serial No. 352,594, filed August 14, 1940.

In accordance with the present invention the wall 2 of the core, which, as above noted, consists predominantly of fibrous material, comprises (Fig. 3[a]) at least three concentric strata 7, 8 and 9, respectively. The outer and inner or exposed strata 7 and 8 are hard, dense and wear resistant, while the intermediate stratum 9 is less dense and more resilient, thereby providing a cushioning effect and a high degree of tenacity which enables the outer and inner strata, shells or skins to withstand stresses better than though the entire wall of the core were of the same hardness as the outer and inner skins. These three concentric strata knit together during the formation of the core and thus constitute an integral mass.

As illustrated in Fig. 3[a], the fibers which form the outer and inner strata or skins 7 and 8 are predominantly substantially coaxial and disposed to extend circumferentially of the core; ideally, the individual fibers adjacent to the exposed surface, at least, of said inner and outer strata form arcs of circles described about the axis of the core. In these inner and outer layers the parallelly disposed fibers are densely and closely arranged. However, in the intermediate layer 9 the constituent fibers are indiscriminately oriented, that is to say, they extend in all directions and are more or less snarled and intertangled and form a mass which is substantially less dense but more resilient than the layers 7 and 8 at opposite sides of it.

While in the above discussion it is indicated that the wall of the core comprises three distinct circumferentially continuous circular strata or layers 7, 8 and 9, it should be understood that these is no exact line of demarcation between the intermediate layer and the respective inner and outer layers, the substantially parallel arrangement of the fibers at the exposed surfaces of the inner and outer layers gradually giving way to the indeterminately disposed fibers of the intermediate layer so that the several layers are integrally merged one with the other and the entire wall thickness may be regarded in the broad sense as consisting of a single integrally united, seamless, annular, fibrous mass.

It is to be noted that the wall structure thus above described is quite distinct in its characteristics from previous core wall structures in which, for example, the core wall is made up by winding a piece of sheet material spirally about a mandrel or from such prior proposals as that of nesting one preformed shell within another and then uniting the several spirals or nested shells by adhesive. In accordance with the present arrangement, as already noted, there is no distinct line of demarcation in passing from the inner surface of the core to its outer surface; there are no alternating layers of sheet material and adhesive but, on the contrary, the bonding agent interpenetrates the entire substance of the wall and unites all of its constituent fibers in an integral mass. Moreover, in the present arrangement the inner surface 3 of the core is smooth and ribless and substantially a true right conical surface, as contrasted with a core made by winding sheet material whose inner surface ordinarily presents a rib at the starting point of the winding. Thus the core fits snug and true upon the mandrel or arbor of the winding or unwinding machine.

While the outer surface of the core may also be smooth and is substantially devoid of any longitudinal ribs or fins and, during the later stages, at least, of its formation is a right conical surface, it is preferred in accordance with the present invention to make the completed outer surface 4 of such character as to prevent shifting of the yarns thereon even though the yarn be of a slippery wiry nature such as rayon. To this end, as illustrated in Figs. 1, 4 and 7 particularly, the outer surface may be provided with a series of minute ribs 10 with intervening grooves 11. As illustrated, the ribs 10 form portions of a continuous helix or screw thread of low pitch, for example, approximately twenty turns per inch, more or less, extending from adjacent to the lower end of the core to the region of the cap 6. However, substantially equivalent effects may be obtained by the use of a multiple screw thread, or the yarn-retaining surface may consist of independent peripheral ribs each lying in a plane perpendicular to the axis of the core, instead of forming the turns of a helix.

Merely as indicative of a useful dimension for such ribs, it is suggested that the distance between the crests of adjacent ribs 10 may be approximately 0.05 inch (Fig. 7) and that the height of the rib, measured above the surface defined by the bottoms of the intervening grooves, may be substantially less than one-half the distance between the crests of adjacent ribs. Thus, merely by way of example, the depth of the groove may be 0.007 inch. As indicated in Fig. 4, the ribs and grooves are preferably of curved contour in transverse section.

In accordance with a preferred procedure the grooves 11 and the ribs are produced by the application of pressure to the outer surface of the core during the latter stages of its production. Whether produced by pressure or otherwise, the completed article has structural characteristics substantially as shown in Fig. 4, wherein the fibers constituting the outer stratum 7 of the core body are shown in transverse section as single dots. Assuming that the ribs and grooves are formed by the application of pressure, as suggested, the applied pressure compacts the fibers of the outer stratum so that the bottom of the recess is constituted by fibers of the stratum 7 which have been so displaced as to become very densely packed as shown at 13. The result is that the bottoms of the recesses of the grooves have a polished appearance and a hardness, density and consistency closely simulating that of heavily calendered paper. The outer surfaces of the ribs 10 have a generally similar consistency and appearance as the bottoms of the grooves, though the ribs do not have so high a polish nor so hard a surface as the inner wall of the groove. However, the ribs and grooves are substantially free from projecting fiber ends, although providing a corrugated surface which is highly effective to prevent slippage of yarn wound on the core. Moreover, this surface is far more permanent

than anti-slipping surfaces heretofore proposed and produced by abrading or otherwise raising a nap upon the surface of the core.

While as shown in Fig. 1 the ribs 10 form portions of a continuous helix, it is contemplated that these ribs may be parallel and/or discontinuous. Thus, as illustrated in Fig. 5, the core 1a has an outer surface comprising a multitude of short circumferentially extending ribs or narrow bosses 11a disposed in staggered relation. These discontinuous bosses or ribs will have the same structural characteristics and appearance as the ribs 10 above described, and they also may form parts of a helix, although, as shown, the ribs of Fig. 5 lie in planes substantially perpendicular to the axis of the core.

In Fig. 6 the invention is illustrated as embodied in a cylindrical core 1b, such core having a wall which it is to be understood is of the same internal structure as that above illustrated, the inner surface in this instance being a true right cylindrical surface, and the outer surface being provided with a multitude of ribs 11b with intervening recesses, such ribs and recesses having the same general characteristics as those of the ribs 10 and recesses 11 above described, and being indicated as constituting portions of a low pitch helix or spiral.

While it is contemplated that cores having the characteristics above referred to may be made in other ways, such cores including the specific surface finish above described may readily be prepared in accordance with the specific process set forth in greater detail in the copending application of Perry, Serial No. 352,601, filed August 14, 1940.

It is to be understood, however, that although the yarn-retaining surfaces comprising the ribs 10 and recesses 11 are readily embodied in a core having the wall structure hereinabove specifically described, such a yarn-retaining surface, produced by the pressure of suitably configured formers, may be applied to core bodies made in other ways and having a different internal structure.

It is further to be understood that while certain specific materials have hereinabove been referred to as desirable, the invention is not limited to these particular materials but that other and equivalent substances and arrangements of parts are regarded as within the scope of the invention as set forth in the appended claims.

I claim:

1. A seamless textile winding core predominantly of organic fibrous material and having hard and dense inner and outer surface layers compacted by pressure and an intermediate layer of lesser density, the constituent fibers adjacent to the inner and outer surfaces of the core wall being approximately parallel and extending circumferentially and the fibers forming the intermediate layer being indiscriminately oriented, the wall of the core being of integral construction in which the several layers merge imperceptibly and being of substantially uniform thickness and comprising a binding medium extending as a colloidal network throughout the entire thickness of said wall, the core being balanced about its major axis.

2. A seamless hollow textile winding core predominantly of organic fibrous material, said core comprising a plurality of concentric strata integrally united and imperceptibly merging each with the next, the constituent fibers adjacent to the outer and inner surfaces of the core extending circumferentially, and a binding medium extending as a colloidal network throughout the entire thickness of the core wall, the core being balanced about its major axis.

3. A hollow textile winding core predominantly of organic fibrous pulp but comprising a binder, said core comprising a plurality of seamless concentric annular layers each layer being integrally joined and imperceptibly merging throughout its periphery with the adjacent layer, the exposed layers being hard, dense, and resistant to deformation and the intermediate layer being less dense and more resilient.

4. A hollow seamless article of the class described consisting predominantly of an integrated mass of organic fibrous material, said article comprising a plurality of layers, imperceptibly merging with one another, the constituent fibers which lie adjacent to the inner and outer surfaces of said article extending generally parallel to each other and predominantly in a circumferential direction while the fibers which are included between said inner and outer surface layers are indiscriminately oriented.

5. A seamless hollow winding core having concentric conical inner and outer surfaces, the core being of fibrous material and comprising inner and outer strata in which the constituent fibers extend predominantly in a circumferential direction, and an intermediate stratum in which the fibers are indiscriminately disposed, the several strata being integrally joined.

6. A seamless hollow textile winding core comprising fibrous organic material and a binder, said core being dense, moisture-resistant and balanced with respect to its major axis, the wall of the core including inner and outer strata in which a majority of the constituent fibers approximate arcs of concentric circles, and an intermediate stratum whose constituent fibers are indiscriminately oriented.

7. A seamless hollow article having concentric inner and outer surfaces, said article being predominantly of paper stock but including a resinous binder, the peripheral wall of the article comprising inner and outer strata in which the constituent fibers extend predominantly in a circumferential direction and an intermediate stratum in which the fibers are indiscriminately disposed, the several strata merging imperceptibly with one another to form an integral structure, and the binder extending as a colloidal network throughout the entire thickness of the wall of the article.

8. A seamless hollow article having a peripheral wall of annular transverse section, said wall being predominantly of fibrous organic material but including a colloidal binder of a kind which becomes irreversible in phase after it has set, the peripheral wall of the article comprising inner and outer strata and an intermediate stratum, the fibers extending predominantly in a circumferential direction in the inner and outer strata and being indiscriminately oriented in the intermediate stratum, the binder being in set condition and forming a colloidal network extending throughout the thickness of the wall.

9. A seamless, flangeless, elongate, hollow textile core predominantly of organic fibrous material but including a colloidal binder, the wall of the core being annular and of substantially uniform thickness whereby the core is balanced about its longitudinal axis, the wall of the core comprising three concentric strata imperceptibly merging with one another, the fibers forming

said strata being so disposed that the outer and inner strata are relatively harder and denser than the intermediate stratum and the binder extending as a colloidal network throughout the entire thickness of the wall.

10. A seamless, flangeless, elongate, hollow textile cone predominantly of organic fibrous material, the wall of the cone being annular and of substantially uniform thickness whereby the cone is balanced about its longitudinal axis, the wall of the cone comprising three concentric imperceptibly merging strata, the fibers forming said strata being so disposed that the inner and outer strata are harder and denser than the intermediate stratum, and a binder comprising a synthetic resin in set, irreversible phase impregnating the wall throughout its entire thickness.

11. A seamless, flangeless, elongate, hollow textile cone predominantly of organic fibrous material, the wall of the cone being annular and of substantially uniform thickness whereby the cone is balanced about its longitudinal axis, the wall of the cone comprising three concentric strata, the fibers in the outer and inner strata being differently arranged from those in the intermediate stratum and so disposed that the outer and inner strata are harder and denser than the intermediate stratum, a colloidal binder in set, irreversible phase impregnating the entire thickness of the wall, the outer surface of the outer stratum being so constructed and arranged as to oppose slippage of yarn thereon.

12. A seamless hollow winding core having concentric conical inner and outer surfaces, the core being of fibrous material and comprising inner and outer strata in which the constituent fibers extend predominantly in a circumferential direction and an intermediate stratum in which the fibers are indiscriminately disposed, the several strata being integrally joined, the outer surface of the outer stratum comprising circumferentially extending ribs, each rib being smoothly rounded and substantially symmetrical in transverse cross section, said ribs forming successive portions of a continuous low-pitched helix extending longitudinally of the core, said helix having approximately twenty turns per inch.

13. A seamless, flangeless, elongate, hollow textile cone predominantly of organic fibrous material, the wall of the cone being annular and of substantially uniform thickness whereby the cone is balanced about its longitudinal axis, the wall of the cone comprising three concentric strata, the fibers in the outer and inner strata being disposed to extend predominantly in a circumferential direction while those composing the intermediate stratum are irregularly arranged whereby the outer and inner strata are harder and denser than the intermediate stratum, and a colloidal binder in set, irreversible phase impregnating the entire thickness of the wall, the outer surface of the outer stratum having a multitude of circumferentially extending ribs operative to prevent slippage of yarn lengthwise of the cone.

14. A seamless hollow textile winding core comprising fibrous organic material and a binder, said core being dense, moisture-resistant and balanced with respect to its major axis, the wall of the core including inner and outer strata in which a majority of the constituent fibers approximate arcs of concentric circles and an intermediate stratum whose constituent fibers are indiscriminately oriented, the inner surface of the wall of the core being smooth and devoid of ribs or fins and of substantially right conical curvature, the outer surface of the core being hard, dense and water-resistant and formed with a multitude of minute ribs, the ribs being separated by intervening grooves, the material forming the bottoms of the grooves having substantially the smooth and dense texture of highly calendered paper.

15. A seamless hollow winding core having concentric conical inner and outer surfaces, the core being of fibrous material and comprising inner and outer strata in which the constituent fibers extend predominantly in a circumferential direction and an intermediate stratum in which the fibers are indiscriminately disposed, the several strata being integrally joined, the outer stratum being impregnated at the end portion of the core with a tip-forming substance and forming an integral tip whose outer surface has a smooth polish and a density and hardness characteristic of highly calendered paper.

16. A seamless hollow textile winding core comprising fibrous organic material and a binder, said core being dense, moisture-resistant and balanced with respect to its major axis, the wall of the core including inner and outer strata in which a majority of the constituent fibers approximate arcs of concentric circles and an intermediate stratum whose constituent fibers are indiscriminately oriented, the outer stratum being impregnated, at the end portion of the core, with a tip-forming substance and forming an integral tip whose outer surface has the smooth polish, density and hardness characteristic of a hot burnished surface.

EUGENE L. PERRY.