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CHUCK FOR TUBULAR CORES

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This invention relates to the winding of strands, threads, and the like into packages and more particularly to an improved apparatus for holding a tubular yarn core while a filament or yarn is wound on at high speeds.

In the textile industry, yarns are often wound on tubular cores which are supported on rotatable chucks driven by rolling contact with a drive roll. Several considerations enter in to the problem of designing a commercially suitable chuck. The rotatable chuck should be designed to permit easy placement and removal of the core upon which the yarn is wound. Furthermore, the chuck must be so constructed to insure firm securance of the tubular core during all phases of the winding operation, i.e., at various wind-up speeds and at various stages of yarn build-up on the core. Centrifugal forces acting on the core package, particularly at higher rotational speeds, become a significant problem in the attainment of commercially suitable yarn packaging equipment. Maintaining concentricity of the core about the spindle at higher speeds becomes a significant problem as does balancing of the winding assembly.

It is therefore an object of this invention to provide a rotatable chuck having the desired characteristics mentioned above.

The present invention provides a chuck adapted to receive a tubular core, the chuck comprising a spindle, a tubular housing rotatably mounted on the spindle, retainer means for holding the rotatable housing on the spindle, and certain types of annular rings mounted on the tubular housing including: (1) a first type being made of a relatively rigid but slightly depressible material and having an outside diameter substantially the same as the inside diameter of the tubular core; (2) a second type being made of a relatively compressible material having a relatively high coefficient of friction and having an outside diameter slightly greater than the inside diameter of the tubular core; and (3) a third type being made of a material capable of radial expansion due to centrifugal forces and having an outside diameter slightly less than the inside diameter of the tubular core.

The invention will be more readily apparent from the following detailed discussion of the embodiments thereof when taken together with the accompanying drawings wherein:

FIGURE 1 is a fragmentary end view of a traverse winding apparatus incorporating the chuck construction of the present invention;

FIGURE 2 is a longitudinal section of the chuck with a tubular core in place;

FIGURE 3 is a side elevation of a centering ring;

FIGURE 4 is a line on **4—4** of FIGURE 3;

FIGURE 5 is a side elevation of the compressible ring;

FIGURE 6 is a line on **6—6** of FIGURE 5;

FIGURE 7 is a side elevation of the expendable rubber ring; and

FIGURE 8 is a line on **8—8** of FIGURE 7.

The traverse winding apparatus shown in FIGURE 1 includes as components thereof a drive roll **1** and a swing arm **3** on which a chuck **5** is freely rotatable. The chuck has a tubular core **7** telescoped thereon and is driven by rolling engagement with the drive roll. In this manner a filamentary structure **9** is wound onto each core to form a yarn package.

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Referring to FIGURE 2, housing **11** is rotatably mounted on spindle **13** by means of bearings **15**. These bearings are held in position on the spindle by tubular bearing spacer **17**, spindle shoulder **19** and lock nut **21**. Housing **11** is held in position by threaded retainer ring **23**. Mounted on the housing are core centering rings **25**, expandable rings **27**, preferably made of rubber, and compressible, gripping ring **29**. Expandable rings **27** and compressible ring **29** are held in retainers **31**. The retainers holding rings **27** are held in spaced relationship by tubular spacers **33** and **35**. A clearance between retainers **31** and rings **27** is provided for radial expansion of the rings. The entire ring and spacer assembly is held in position by lock nut **37**. A circumferential stop **39** extending out radially is provided on the tubular housing **11** to abut one end of tubular core **41**.

Referring to FIGURE 3, centering rings **25**, although constructed of relatively rigid material, are designed to depress slightly when the core is placed on the chuck. The centering rings may suitably be constructed of spring steel, but are more economically fabricated from plastic material such as nylon, polycarbonates, polyethylene or polyformaldehyde. Particularly suitable materials are polyhexamethylene adipamide (6–6 nylon) and polyhexamethylene sebacamide (6–10 nylon). Preferably, a resilient support **43** (shown in FIGURE 2) is provided for the depressible part of the ring. This resilient support, which may suitably consist of a ring of elastomeric material such as a natural or synthetic rubber or a flexible foam such as a flexible polyurethane foam, is fitted snugly against the underside of the depressible portion of the centering ring, and serves to prevent the centering ring from acquiring a permanent set under the tubular core pressure. GR-S cold rubber, having a specific gravity of 1.15 and a modulus of elasticity of about 1400, is satisfactory for this purpose.

Since the relatively rigid material required for construction of centering rings **25** does not provide sufficient gripping force to hold the core **7** firmly in place in the initial stages of the winding operation, ring **29** is provided for this purpose. The outside diameter of ring **29** is slightly greater than the inside diameter of the tubular core **7** and the ring is composed of a readily compressible material having a high coefficient of friction. A foamed structure such as flexible polyurethane foam is particularly suitable for this purpose. As illustrated in FIGURE 5 and 6, in a preferred design, a number of cleats **45** for contacting the tubular core **7** are provided around the outer periphery of ring **29** to facilitate compression of the ring when the core is put in place. For the same reason, semi-circular cavities **47** are preferably provided below each of the cleats. Preferably this material should have a durometer hardness of 25–35.

Expandable gripping rings **27**, one of which is shown in FIGURES 7 and 8 are suitably made of relatively high density elastomeric material such as synthetic or natural rubber. These rings expand under the action of the centrifugal force generated at high winding speeds and serve to grip the core tightly under the conditions of high stress imposed by the high speeds and accumulation of yarn.

Spacers **33** and **35** may be made of metal but are more economically fabricated from resin-impregnated paper or similar laminated materials.

Bearing spacer **17** and housing **11** are suitably made of steel or other appropriate metal. The ring retainers **31** may be made of metal, but are more economically constructed from a plastic material such as 6–6 nylon.

Preferably, stop **39** is designed in such a manner as to serve the dual purpose of a stop for the core and as a driving wheel to prevent the drive roller from contacting the empty core at the beginning of the winding operation.