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YARN WINDING APPARATUS

Filed July 7, 1937

FIG. 1

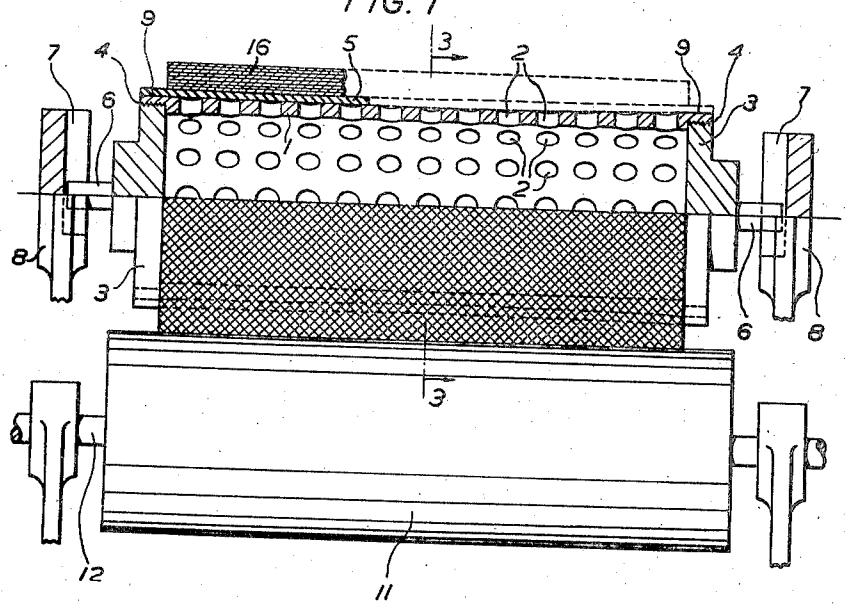



FIG. 2

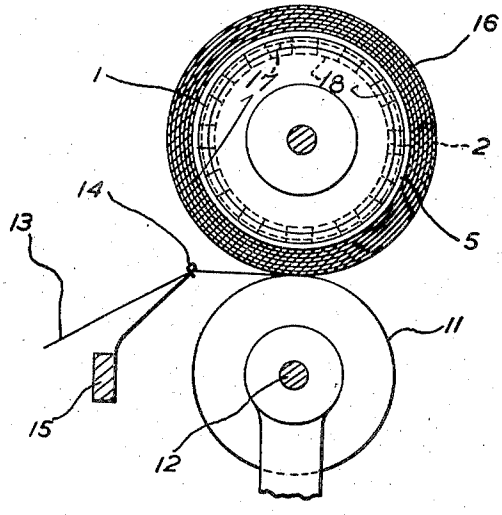
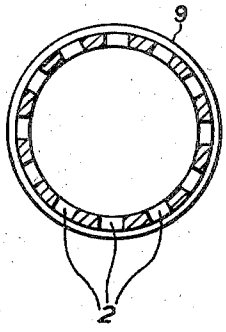



FIG. 3




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## YARN WINDING APPARATUS

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7 Claims. (Cl. 242—43)

The present invention relates to yarn winding apparatus and more particularly to drum-winding apparatus of the type adapted for the production of cross-wound cheeses, cones, or like packages having self-supporting ends. In drum-winding apparatus it is customary to build cheeses and the like on package formers or supports which are pressed into contact with the surface of the drum and are rotated by frictional contact therewith, the yarn being traversed to and fro along the length of the former either by a traverse slot formed in the drum or by a separate traversing device disposed in the vicinity of the support. It is necessary in order to form packages having firm, straight ends to adjust the tension in the yarn proceeding to the package to a degree such that the layers of yarn firmly grip the preceding layers and the package former. In this manner a compact, solid package of yarn is built which can be handled and subsequently unwound without danger of the ends of the package collapsing.

When a cross-wound package of yarn is subjected to wet treatment such as dyeing, however, the compactness of the yarn tends to resist penetration of the package by the treating media, with the result that the whole of the yarn in the package is not uniformly treated. If an attempt is made to overcome the difficulty by winding the yarn at less than normal tension the resulting package is "soft" and insecure on the former and even if the ends of the package do not collapse altogether, lengths of yarn laid at the points of reverse of the traverse fall over the ends of the package and cause serious difficulties in the subsequent unwinding operation.

It is an object of the invention to produce well-built cross-wound packages of yarn which can be uniformly treated in operations of the type referred to above and can be handled and unwound without difficulty.

According to the invention yarn is cross-wound on a substantially cylindrical former or package-support the diameter of which reduces progressively towards the middle to form a "waist". The "waisted" or concave nature of the package support has the effect of progressively decreasing the tension in the yarn as it is wound from an end of the package towards the middle and of progressively increasing the tension as the yarn is wound from the middle towards the other end of the package. The yarn is wound on the former under low tension of a degree such that would normally tend to allow of a "soft" package being built, it being found, however, that the progressive increase in tension in the yarn due to the progressive increase in diameter of the support towards its ends causes the yarn to wind firmly and securely at the ends of the package, the ends being solidly built without fallen lengths of yarn and resisting any tendency to shifting of the yarn on the former.

A sheath of flannel or similar material is preferably provided for the support and may be secured thereto at the ends of the support on portions of normal diameter, the sheath thus extending over the waisted portion and providing along the greater part of the length of the support a soft resilient package foundation which, however, enables a straight-ended package to be built.

The soft-wound nature of the package tends to increase the degree of frictional contact between the package and the surface of the driving drum and allows of a reduction in the pressure normally necessary between the package and the drum, without danger of undue slippage. The reduction in pressure in turn assists in preserving the soft-wound nature of the package.

Cross-wound packages of yarn produced according to the invention can be penetrated thoroughly by treating media, e. g., solutions of dyestuffs. The penetration is particularly thorough when the support is perforated and the sheath is of permeable material so as to enable the treating media to be circulated through the perforations in the support, the whole of the yarn in the package being treated uniformly. While the ends of a package are wound more tightly than the main body of the package, the treating media have free access to the ends through the softer wound body of the package, the ends being treated to substantially the same degree as the yarn in the remainder of the package. The packages allow, moreover, of very high rates of unwinding of the yarn while preserving uniformity of tension, without the difficulties usually experienced in connection with soft-wound packages.

By way of example, a form of apparatus according to the invention will now be described in greater detail with reference to the accompanying drawing, of which

Fig. 1 is a somewhat diagrammatic part cross-sectional front elevation of a drum winding device adapted for the production of cross-wound cheeses;

Fig. 2 is a part cross-sectional end elevation of Fig. 1; and

Fig. 3 is a somewhat diagrammatic cross-

sectional elevation of a part of Fig. 1 taken on the line 3—3.

Referring to the drawing, the former or package support consists of a hollow substantially cylindrical core 1 formed with perforations 2 and supported at its ends by discs 3 each having a threaded periphery 4 which enables the disc to be screwed into and out of the former. The support is covered with a sheath 5 of flannel or like yieldable permeable material.

The discs 3 are provided with journals 6 which are rotatably supported in open bearings 7 formed in brackets 8 of the machine frame.

With the exception of a short parallel portion 9 at each end the diameter of the package support 1 reduces gradually towards the middle to form a "waist", shown in Fig. 3 in cross-section. The sheath 5 is secured to the support at the portions 9 only and conforms to the concave surface of the support 1.

In Fig. 2 the waist-like shape of the package support is indicated by the dotted lines 17 and 18, the line 17 indicating the circumference of the package at a point midway along its length, while the line 18 indicates the inner surface of the package which is of uniform diameter along the length of the package.

At the commencement of the winding operation, the support 1 rests on the surface of a driving drum 11 carried on a driving shaft 12, the support thus being driven by frictional contact with the drum. Yarn 13 fed from any suitable source of supply (not shown) is guided to and fro along the length of the support by a guide 14 secured to a reciprocating traverse rod 15. The rate of reciprocation of the rod 15 is such as to cross-wind the yarn 13 on the support, the building of the yarn on the support forming a package 16 of gradually increasing thickness. The open bearings 7 permit the journals 6 to rise as the diameter of the package increases.

The tension in the yarn 13 is adjusted to be as low as possible consistent with steady running of the package 16 and is such as would normally tend to allow a "soft" package being built. The increase in the diameter of the former 1 towards its ends, however, causes the tension progressively to increase as the yarn approaches the ends of the package with the result that while the middle portion of the package is soft, the ends are firm and are free from the disadvantages usually inherent in a soft wound package.

Thus, as the yarn 13 is traversed along the length of the support 1, it first winds on a portion 9 of large diameter, and as traversing proceeds towards the middle of the support the yarn is wound on portions of gradually decreasing diameter, the tension in the yarn progressively decreasing in consequence, until the middle portion is passed, when the tension progressively increases as it proceeds towards the other end of the package. On the return of the traverse a similar variation in tension occurs, and so on, throughout the building of the package 16, the completed package being on the whole, of soft nature, and yet having firmly built ends, i. e., the density of the package reduces progressively from the ends towards the middle.

The soft-wound nature of the package according to the invention enhances the frictional contact between the package and the driving drum 11, and in forming packages which, by reason of the nature of the yarn and/or the package support, customarily require to be pressed into contact with the drum (e. g., by means of a weight and lever device) before satisfactory frictional contact is obtained, the invention enables the degree of such pressure to be reduced.

Since the sheath 5 is attached at its ends only to the support 1, the middle portion of the sheath (viz., the portion covering the "waist" of the support) provides a very resilient support for the yarn 13 wound on the middle portion of the package and assists in enabling successful soft winding of such portion of the package to be effected. The resiliency of the sheath, however, does not prevent the building of a package having firm, straight ends.

When the package 16 is completed the discs 2 are unscrewed from the ends of the support 1 and the package is ready for subsequent treatment, the perforations 2 formed in the support enabling treating media to be passed from the inside of the support outwardly through the yarn on the package, or vice versa. While the ends of the package are wound more tightly than the main body thereof, the treating media have free access to the ends through the softer wound body of the package, the ends being treated to substantially the same degree as the yarn in the remainder of the package.

While the invention is applicable to the winding of any type of yarn which is to be subjected to treatment in package form, it is especially suitable for use in connection with the winding of yarn containing dense filaments or fibres, since normally-wound packages of such yarn are extremely compact, and offer high resistance to penetration by treating media. For example, the invention may be employed with advantage in the winding of packages of artificial silk yarn of any kind and especially when such packages are to be subjected to treatments with liquids, since the whole of the yarn in a package is substantially uniformly treated with the liquids.

The packages formed in accordance with the invention are also of advantage when the yarn thereon is to be subjected to the action of gases, e. g., in drying operations.

Having described our invention, what we desire to secure by Letters Patent is:

1. Apparatus for producing a cross-wound package of yarn, comprising a substantially cylindrical package support the diameter of which reduces progressively towards the middle to form a "waist", means for rotatably holding the support, means for driving the support, and means for traversing yarn repeatedly from end to end of the support.

2. Apparatus for producing a cross-wound package of yarn, comprising a substantially cylindrical package support having short parallel portions at each end and having its diameter reduced from such portions progressively towards the middle to form a "waist", a sheath of yieldable material covering the support and secured at its ends to the parallel portions of the support, means for rotatably holding the support, means for driving the support, and means for traversing yarn repeatedly from end to end of the support.

3. Apparatus for producing a cross-wound package of yarn, comprising a substantially cylindrical perforated package support having

short parallel portions at each end and having its diameter reduced from such portions progressively towards the middle to form a "waist", a yieldable sheath of permeable material secured at its ends to the parallel portions of the support, means for rotatably holding the support, means for driving the support, and means for traversing yarn repeatedly from end to end of the support.

4. A substantially cylindrical yarn package support the diameter of which reduces progressively towards the middle to form a "waist."

5. A yarn package support comprising a substantially cylindrical perforated hollow core the diameter of which reduces progressively towards the middle to form a "waist," and a permeable sheath of yielding material covering the core.

6. A cross-wound package of yarn, comprising a substantially cylindrical package support the diameter of which reduces progressively towards the middle to form a "waist" and a plurality of cross-wound layers of yarn on said support, each of said layers extending from end to end of the support and being under a tension which is progressively less from the ends of said support towards the middle.

7. A cross-wound package of yarn, comprising a substantially cylindrical perforated package support having short parallel portions at each end and having its diameter reduced progressively towards the middle to form a "waist," a yieldable sheath of permeable material secured at its ends to the parallel portion of the support, and a plurality of cross-wound layers of yarn on said support, each of said layers extending from end to end of the support and being under a tension which is progressively less from the ends of said support towards the middle.

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