Sept. 3, 1968 AKIRA HAYASHI 3,399,761

YARN PACKAGE

Filed June 19, 1967 3 Sheets-Sheet 1

FIG. 1

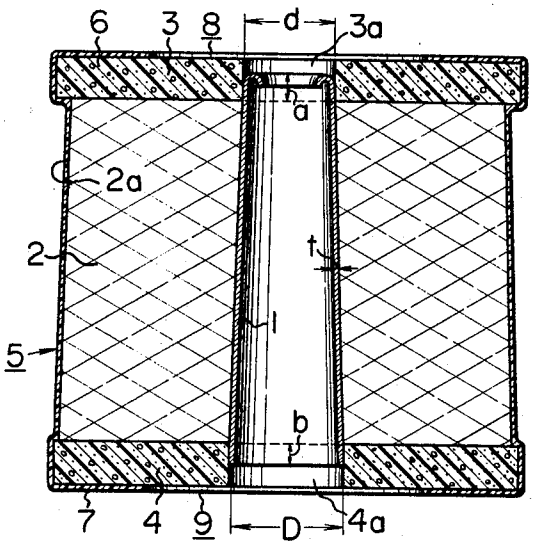


FIG. 3

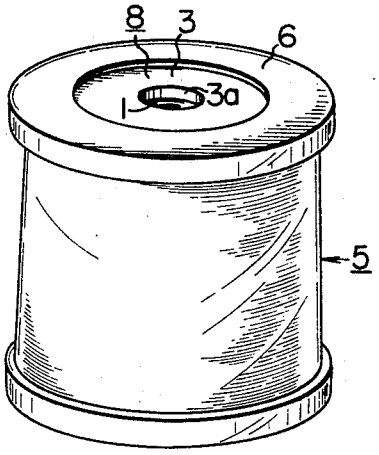


FIG. 2

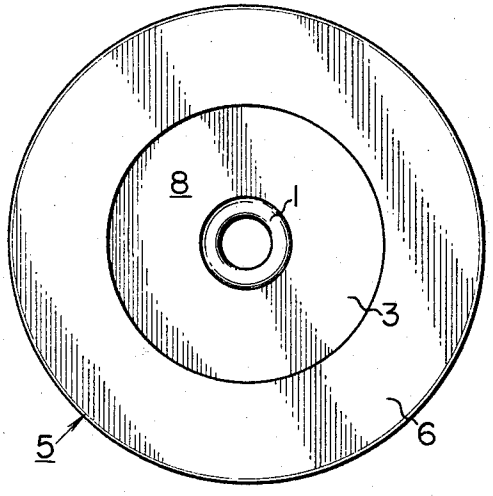
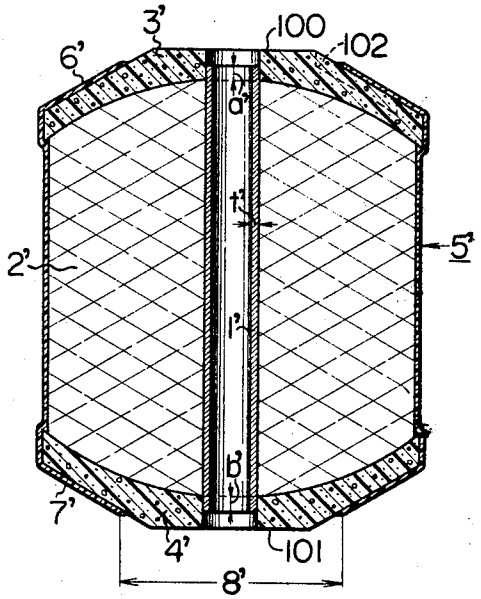


FIG. 4



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YARN PACKAGE

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FIG. 5

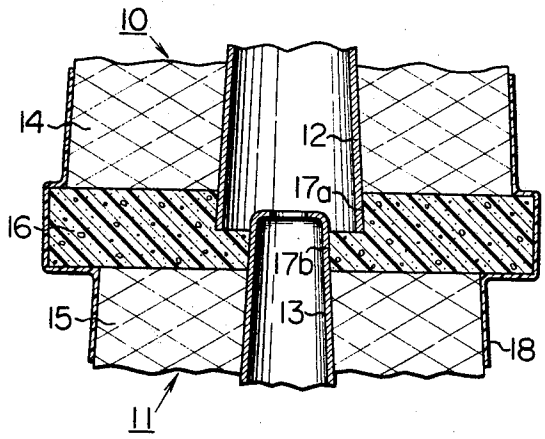

FIG. 6

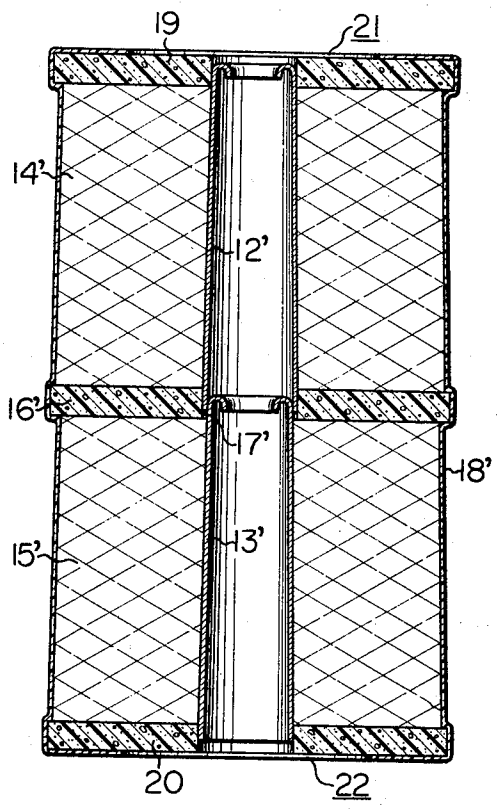

FIG. 10

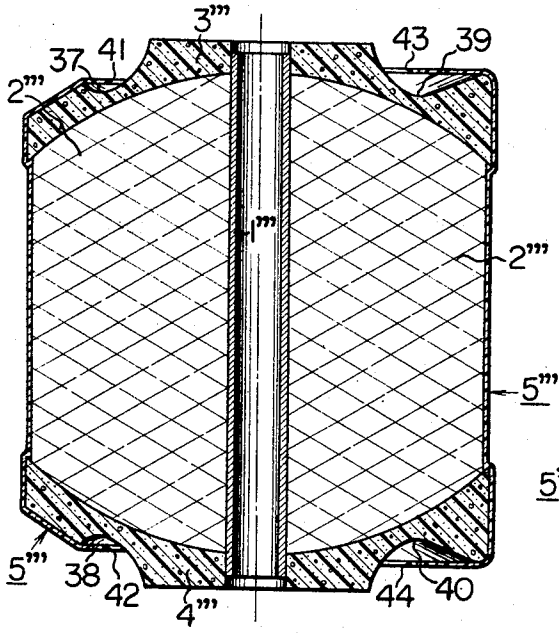

FIG. 8

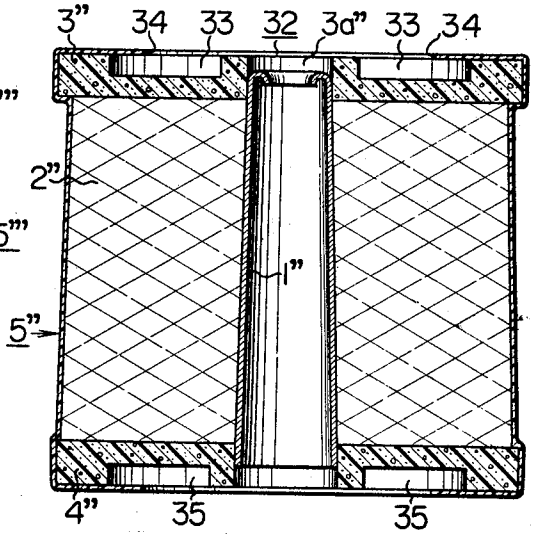

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FIG. 9

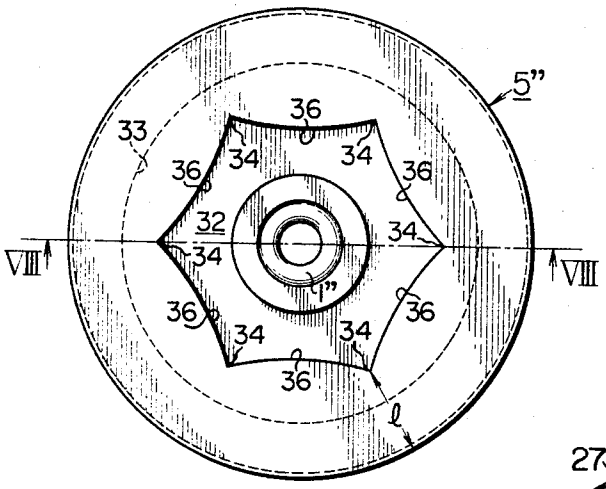


FIG. 7

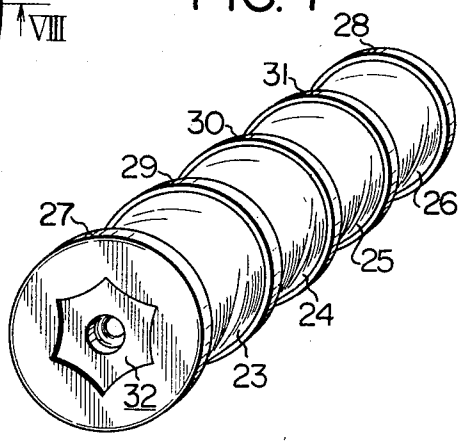


FIG. 11

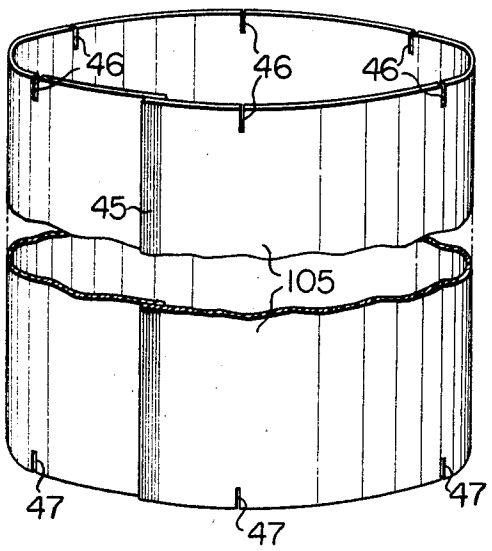
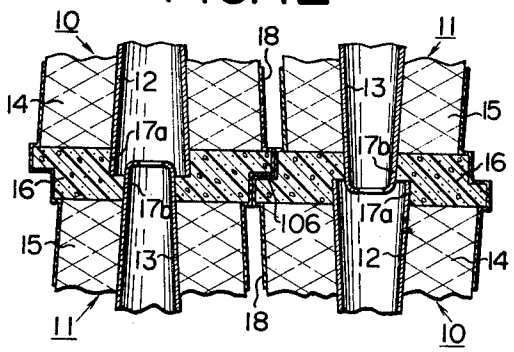


FIG. 12



United States Patent Office 3,399,761 Patented Sept. 3, 1968

3,399,761

YARN PACKAGE

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Claims priority, application Japan, July 4, 1966 (utility model), 41/62,364 (utility model), 41/62,365; Feb. 14, 1967 (utility model), 42/11,844, 42/9,122
10 Claims. (Cl. 206—65)

ABSTRACT OF THE DISCLOSURE

A yarn package containing one or more wound yarn masses on respective cores arranged in a stack, wherein a ring pad of foamed synthetic resin is placed on each outer end of the yarn mass-core assembly and between each pair of neighboring yarn masses of the latter, the whole assembly being enclosed substantially by a heat-shrunk protecting film, with a limited central area on each of the end surfaces of the yarn mass uncovered by the film for avoiding possible concentration of crimps otherwise to be caused by the heat shrinking of the film.

This invention relates to a novel package of yarn and the like elongate fibrous and wound-up material.

Various daily commodities are nowadays thermally sealed off by means of thermally shrinkable thin films of synthetic resin such as polyvinyl chloride, polyvinylidene chloride, polypropylene, polyamide, polyethylene the like. It has been also put into practical use, to package a number of masses of wound yarn, for instance, in the form of cones, cheeses, bobbins and the like, separately or in a stack, by means of protecting films of the above kind, through the way of provisionally and roughly enclosing the wound yarn mass by the film and then either injecting upon the latter any suitable heated gaseous medium such as hot air, steam and the like, or projecting thermal radiation from a heat source such as ultrared heater upon the film.

For this purpose, cylindrical film tubes are advantageously used, but in this case, it has been found that especially when the yarn consists of sensible and delicate chemical filaments, such as those of nylon, polypropylene, acrylonitrile, polyester, viscose rayon, acetate or the like, the heating energy affects adversely and considerably upon the nature of the filaments, resulting frequently in deterioration, discoloring and the like defect in the filament material.

Another grave disadvantage as met with the conventional heat-sealed yarn pacakge resides in that considerable and tremendous crimps appear in the central zone on each of the end surfaces of the cone, cheese or the like wound yarn mass, where the end extremity of a heat-shrunk film cylinder is concentratedly applied over a limited central area and the heat shrinkage of the film can not take up the crimps.

Still another conventional grave disadvantage resides in that peripheral edges of the wound yarn mass are liable to be subjected to mechanical damages caused by contact with a foreign rigid body, especially during the heat shrinkage packing process, or even in the course of shipping upon packaged with the protecting film of the kind above referred to. When the yarn consists of sensitive and fine filaments. This problem becomes more considerable.

For avoiding the aforementioned conventional drawbacks and starting from the cored and packaged yarn with a heat-shrunk protecting film, the invention is characterized by that the wound yarn mass is covered at each of its end surfaces by a ring pad of foamed synthetic resin, and that the assembly consisting of the yarn mass,

its core and the pads is enclosed substantially entirely by a heat-shrunk protecting film, leaving a limited central area on each of the outer end surfaces of said ring pads uncovered by said film.

As the material for the pads, foamed synthetic resin such as polystyrol, polyurethane, polyethylene, polypropylene or the like, which has proper yarn-protecting properties such as cushioning performance, heat-insulating power, moisture-proofness and the like.

The pads are made preferably by the injection molding process. Under circumstances, pads may be cut from a foam resin sheet stock. It can also be possible to prepare the pads by slicing a round bar stock of foam resin.

As the protecting film, biaxially heat-shrinkable synthetic resin such as polyamide, polyvinyl chloride, polyurethane, polyethylene, polypropylene or the like may be effectively adopted. This thickness of the film may preferably amount to 10–50 microns. The film is applied shrinkingly upon the pad-yarn-and-core assembly, generally at 80–250° C. for 3–12 seconds.

These and further objects, features and advantages of the invention will become more apparent when read the following detailed description of the invention by reference to the accompanying drawings illustrative of several preferred embodiments of the invention given by way of example and thus in no limiting sense.

In the drawings:

FIG. 1 is a longitudinally sectional view of a first embodiment of the invention wherein the novel teaching thereof has been embodied in a single cone spooled winding.

FIG. 2 is a top plan view thereof.

FIG. 3 is a perspective view of the yarn package shown in FIGS. 1 and 2.

FIG. 4 is a longitudinally sectional view of a second embodiment of the invention as applying the principles of the invention to a single parallel cheese winding.

FIG. 5 is a part of a longitudinal section of a third embodiment of the invention wherein the principles thereof have been applied to a stack of two cone cheese windings which stack is included in the broader meaning of "a stack of yarn mass" as claimed herein, yet excluding its conical cores.

FIG. 6 is a complete longitudinal section of a fourth embodiment of the invention, somewhat modified from the foregoing third embodiment.

FIG. 7 is a perspective view of a stack of four cones spooled windings as a modification from the foregoing fourth embodiment of the invention.

FIG. 8 is an axial sectional view of a fifth embodiment of the invention, being somewhat modified from the first one shown in FIGS. 1–3.

FIG. 9 is a top plan view of the yarn package shown in FIG. 8.

FIG. 10 is a similar view to FIG. 8, illustrative of a further yarn package as a sixth embodiment of the invention, being somewhat modified from the second embodiment shown in FIG. 4.

FIG. 11 is a perspective view of a heat-shrinkable film cylinder adapted for use as the protecting film for the completion of a yarn package according to this invention.

FIG. 12 is a part of a vertical section of an array of a number of yarn packages arranged for convenient shipping.

Now referring to the accompanying drawings, especially FIGS. 1 and 2 thereof, numeral **1** denotes a conical and hollow core, preferably made of paper or plastic material, for instance, polypropylene, and **2** represents a mass of yarn wound on the conical core **1**, and again in the shape of a cone. The top end of the core **1** is turned

round inwardly so as to represent a smooth edge and protrudes a distance denoted *a* which may amount to 4–14 mm. as an example, upwardly of the mass of yarn **2**. As an example, the upper or smallest outside diameter, denoted *d*, of the core **1** may amount preferably to 10–80 mm.; the lower or largest outside diameter, denoted D and the wall thickness *t* may be 20–100 mm. and 1-10 mm., respectively, while the height of the core **1** may amount to 100–300 mm. The base end of the core **1** protrudes a distance *b* which may be 4–14 mm., as an example, downwardly of the mass of yarn **2**, the latter comprising 20–50 filaments of synthetic fiber material such as nylon, polyester, acrylonitrile, polypropylene, viscose rayon, acetate or the like.

Numeral **3** denotes a first or upper pad made preferably of a foamed synthetic hard resin, such as foam polystyrene, yet having a certain grade of resiliency and being formed into a circular ring with a central bore at **3***a*, the diameter of which is, when the ring is kept in its natural dimensions, slightly smaller, say 0.2–1 mm., than the smallest upper diameter, *d*, of the core **1**. With the upper or smallest outside diameter of the mass of yarn **2** being 120–240 mm., the outside diameter of the ring pad **3** may amount to, from 122–130 to 242–260 mm., as an example, while the thickness of said pad may be 5–20 mm. which is thus larger than the upper protruding distance *a* of the core **1**.

Numeral **4** represents a second or lower pad, made preferably and again of a foamed synthetic resin which may be either the same as or different from the material for the first pad **3** and being formed again into a circular ring. This pad **4** is formed thus a central bore **4***a* of a diameter slightly smaller, say 0.2–1 mm., than the largest lower diameter, D, of the core **1**, when the pad **4** is kept in its natural dimensions of which the outside diameter and the thickness may be 125–260 mm. and 8–25 mm., respectively as an example.

The outer peripheral surface **2***a* of the mass of yarn **2** is completely enclosed by a protecting film **5** which extends both upwardly and downwardly, so as to cover the peripheral surfaces of the both pads **3** and **4**, as well as the outer peripheral zones **6** and **7** of the exposed end surfaces of said pads, as may be well supposed at a glance of FIG. 2 illustrative of the top plan view of the yarn package assembly shown in FIG. 1 and described so far. The film **5** is 10–50 microns thick, as an example and made of a thermally shrinkable resin such as polyvinyl chloride or the like. This film **5** is fixedly attached to the assembly by the thermal shrinking process, as will be more fully described hereinafter. The central circular zone **8** or **9** of the outer end surface of the respective pad **3** or **4** is not covered by the film **5**, but intentionally kept exposed to the ambient atmosphere for the reasons, as was set forth hereinbefore.

As will be clear from the foregoing, the wound-on mass of yarn **2** is completely enclosed by the combination of conical core **1**, pads **3** and **4** and protecting film **5** so that it is practically insulated from the ambient atmosphere and thus moisture, dusts, fouling matters and the like contained therein and constituting outside adverse causes against the yarn mass do not invade into the interior thereof and the mass can be therefore safely protected, even when it is being shipped out.

By the selection of the diameters of the central bores **3***a* and **4***a* to be slightly smaller than those of the related ends of the conical core **1** and thanks to the somewhat resilient nature of the pads **3** and **4**, the contacting surfaces between the core and the pads provide an effective seal, respectively, thereby intensifying the protection of the yarn mass **2** in the above sense.

When the yarn mass **2** consists of a heat sensitive and delicate material and comprises an elongate bundle or composite fine filaments such as nylon or the like and the protective film be attached fixedly thereto by the conventional heat shrinking process without use of the pads attached to the end surfaces of the yarn mass, the heating gaseous medium such as steam will be brought into direct contact with the end surfaces, thence invading into the interior of the mass which results in deterioration and discoloring of the sensitive filaments.

On the contrary and according to the invention, the protecting film is applied through the intermediary of the pads **3** and **4** onto the end surfaces of the yarn mass **2**, and thus, the aforementioned fear can be substantially obviated.

As seen from FIG. 1, the outer periphery of each of the pads **3** and **4** extends radially beyond the related peripheral edge of the yarn mass, thereby providing reliable safeguard means against otherwise possible mechanical damages at these peripheral edges as may be frequently encountered in the course of transportation of the finished package assemblies.

In the similar way, the both ends, especially the top end, of the conical core **1** can be effectively protected by the pads **3** and **4**, especially by the latter, against otherwise possible mechanical damage. If such a damage should be brought about, a smooth and continuous winding-up operation of the yarn from the conical cheese winding may be frequently and adversely affected, as is commonly known by those skilled in the art.

There is left the central zone **8** or **9** on each outer end surface of the pad **3** or **4**, uncovered by the heat-sealingly and shrinkingly attached protecting film **5**. If the film is so processed, as conventionally, as to totally cover these end surfaces of the pads till to the centres of the latter, considerable and severe crimps may develop in the packaging step within the central zone which results in a lowered commercial quality of the packaged cheese winding.

More specifically, in order to cancel out completely the crimps formed by the film tube ends and appearing at the central limited region on the end surfaces of the yarn mass by intensifying the degree of thermal shrinkage of the film through the way of applying the heating medium of considerably elevated temperature such as between 150–200° C. in comparison with that of regularly adopted temperature between 80–150° C., it is of no doubt that the material of the yarn, for instance, polyethylene terephthalate, is considerably insured in its nature.

In the case of the novel package according to this invention, however, this kind of conventional grave drawback can be substantially avoided, because in the above embodiment the both end surfaces of the cheese cone or yarn mass **2** are prevented from contact with the heating medium.

In the yarn package shown in FIGS. 1 and 2, there are uncovered central zones **8** and **9** by the protecting film **5**. The provision of these uncovered central end zones is of great importance. Thanks to this provision, the heat shrinking degree can be considerably reduced at the extremities of the film cylinder, because there practically, no fear of developing crimps of the above sense.

Therefore, the application of heat for the film shrinkage may well be carried into effect at 80–150° C., as was referred to above, and for 3–8 seconds. This heating process will invite only a small rise of the temperature of the yarn, or more specifically 4–10° C. which gives rise naturally no remarkable effect upon the material of the yarn.

This feature is definitely applicable to all the remaining embodiments to be described hereinafter.

In FIG. 3, a reduced perspective view of the complete package shown and described so far.

In the second embodiment of the invention shown in FIG. 4, the conical core **1** in the foregoing embodiment has been replaced by a perfectly cylindrical core **1'**, again hollow, and the parallel cheese or yarn mass at **2'** has convex end surfaces in place of the plane one in the foregoing embodiment. Pads **3'** and **4'** are of a generally convex shape in their diametral section as shown, for better engagement with the end surfaces of the cheese and for

convenient handling of the packaged assembly. Top and bottom plane surfaces at **100** and **101** formed on the pads **3'** and **4'** occupying substantially the uncovered central zones thereon serve effectively for stabilized positioning of the finished yarn package, when it is placed on a stationary support or the like.

Other features and advantages are similar to those embodied in the foregoing embodiment, and thus, several same reference numerals attached each with a prime have been adopted for an easy and better identification with corresponding parts of the first embodiment.

In FIG. 5, a stack of two similar conical cheese cones **10** and **11** is shown only partially. The upper conical cheese **10** comprises a conical core **12** and a mass of yarn **14** wound thereon. In the similar way, the lower conical cheese **11** comprises conical core **13** and a mass of yarn **15** wound thereon.

Between the both cheese cones **10** and **11**, there is provided an intermediate pad **16** made preferably again of foam resin such as foamed polystyrene resin or the like. This pad **16** has a central stepped bore comprising an upper and larger bore part **17***a* for snugly receiving the base end of the upper conical core **12**; and a lower and smaller bore part **17***b* for snugly receiving the upper end part of the lower conical core **13**, as shown. In addition, the pad **16** is kept at its upper and lower surfaces in contact with the bottom ring surface of the upper yarn mass **14** and the upper ring surface of the lower yarn mass **15**. The thus coupled and relatively positioned twin conical cheese **14–15**, including the intermediate pad **16** having a small, but proper amount of resiliency, is enclosed by a protecting film **18**. Although this film **18** is shown only partially in FIG. 5, the overall appearance is similar as that shown at **18'** in FIG. 6. Therefore, the upper and lower cheese elements are connected tightly together and protected in a satisfactory manner, as if they be a single conical cheese shown in FIG. 1. In this case, the upper end of the lower conical core **13** projects a small distance into the interior of the base end of the upper core **12**, but this feature is not a requisite condition for practice of the invention.

The intermediate pad at **16'** of the twin cheese package shown in FIG. 6 is formed with a central plain bore at **17'** in place of the stepped one **17***a*–**17***b* in the foregoing embodiment shown in FIG. 5. In the present embodiment, the upper and lower conical cores at **12'** and **13'** are telescoped together only a small distance, yet to provide a positive and firm mechanical connection therebetween.

Top pad **19** and bottom pad **20** are designed and arranged perfectly in the similar way with those at **3** and **4** in the first embodiment shown in FIGS. 1 and 2, and therefore no further detailed description thereof may be omitted without sacrificing better understanding of the invention.

The intermediate pad **16'** receives with a slight resilient pressure the mechanically coupled part of the both cores **12'–13'**, and thus the thickness of the pad may be smaller than that of the intermediate pad **16** shown in FIG. 5.

In the both embodiments shown in FIGS. 5–6, the intermediate pad **16** or **16'** has a larger diameter than the lower and largest diameter of the upper cheese element, and naturally than the upper and smallest diameter of the lower cheese element, so that even when the twin cheese assembly is laid horizontally on an automatic packaging machine for receiving a protecting film **18** or **18'**, as shown, relying upon the heat shrinking process, the otherwise exposed peripheral edges of the both cheese elements **14'** and **15'** are sufficiently protected against any mechanical damage. The provision of the top and bottom pads **19** and **20** will serve naturally for the same purpose to protect mechanically the upper and bottom peripheral edges. This last mentioned feature is also applicable to the first two embodiments shown in FIGS. 1–4.

The twin conical cheese thus assembled is packaged with the protecting film **18** or **18'**, as referred to above, and without fear of thermal deterioration in the course of the heat shrinking packaging. There are central regions **21** and **22** on the respective outer disc surfaces of the top and bottom pads **19** and **20**, left uncovered by the protecting film from the same reasons as were set forth hereinbefore with reference to FIGS. 1–4.

All the pads **19**, **16** or **16'** and **20** may preferably be so designed as to have a common outside diameter, for better handling in the application of film to the assembly on the automatic packaging machine. This feature is especially useful when the package contains a number of, say, as many as five, cheese elements arranged in a row and mechanically coupled one after another as mentioned with reference to FIG. 5 or 6. In addition, the finished products can more easily and conveniently handled in the course of the preparation of shipping packages with use of carton board containers.

In FIG. 7, a package containing four conical cheeses **23–26** stacked and packaged in the aforementioned way is shown. In this embodiment, the top pad and the bottom pad are designated by **27** and **28**, while three intermediate pads are shown at **29**, **30** and **31** in succession.

The uncovered central zone at **32** formed on the upper surface of the whole package which is however shown substantially in its horizontally turned position, represents a modified polygon, herein shown hexagon by way of example, having concave side edges, in place of a true circle as shown in FIG. 2.

In a further embodiment shown in FIGS. 8 and 9, the upper pad **3''** is formed in its upper surface with a circular groove **33** made concentrically with the central bore at **3***a''* and the upper peripheral edge **34** of the protecting film **5''** runs in a suspended state over the groove. In the similar way, the lower pad **4''** is formed in its bottom surface with a concentric circular groove **35**, the peripheral edge **36** of the lower part of the same protecting film **5''** being kept again in suspended state over the groove **35**. This modified design is intended to provide an easy chance of grippage of the packaging film **5''** when it is desired to remove the pads and to expose the yarn mass **2''** for taking out the yarn therefrom. Other design future of constituent parts including the conical core at **1''** is similar to those which are fitted with similar reference numerals without primes in FIGS. 1 and 2, and therefore no further description may be dispensed with.

In a modification from the embodiment shown in FIGS. 8–9, the circular groove **33** or **35** is replaced by a plurality of radial grooves, serving for the same purpose, as hinted by dotted line at **102** in FIG. 4.

In FIG. 9, there are six sharply defined angular recesses when seen from the side of protecting film **5''**, said recesses being in correspondence to the apexes at **34** of said hexagonal opening or uncovered central zone **32**. The provision of these angular recesses serves for intentional tearing of the protecting film **5''** by a finger's end of the user, when he desires to open the yarn package. The length shown by "*l*" in FIG. 9 may preferably be 10–60 mm., depending upon the size of the cheese and the kind, nature and thickness of the film **5''**.

In FIG. 11, a cylindrical film stock **105** which has been prepared from a film sheet, thus having a longitudinal seam **45**. The film cylinder may be, however, of the seamless mode, when necessary, by preparing it by the conventional extrusion technique. As seen, there are six cut-in slits **46**, which may be 2–20 mm. long, along the upper edge of the film cylinder. In the similar way, there are six slits **47** along the lower edge of the film cylinder **105**.

Upon the heat-shrink application of this film cylinder, the latter contracts considerably and the original length thereof, 10–120 mm. depending upon the overall size of the package, will reduce 20–50% and the each of the end edges of the cylinder will take the form of a polygon, or hexagon in this case, as defined by the provision of said slits. The number of the sides of the polygon may be

increased as high as 20, by increasing the number of said slits. Conversely, the number of said slits can be reduced to only one. In this case, the length of the sole slit may be of the longest possible value, for instance, 20 mm. When there is a longitudinal seam as at **45** on the film cylinder, it can well serve for easy intentional breakage of the protecting film of the finished yarn package.

When the film cylinders are heat-cut in proper lengths from an endless tube, the provision of said slits can be dispensed with, because in this case there would be practically no fear for intentional tearing of the protecting film, when the yarn package is of the embodiment shown in FIGS. 8–9 or FIG. 10.

In FIG. 10, two halves of the drawing represent respective modifications from the second embodiment shown in FIG. 4. The main difference in this case from the foregoing embodiment resides in the sectional configuration of each of the upper and lower pads **3'''** and **4'''**, each representing an outer regional wavy contour, especially formed by the provision of a circular recess **37, 38, 39** or **40**, respectively, having a curved bottom. The marginal edge **41, 42, 43** or **44** of the thermally shrunk protecting film at **5'''** is kept in suspension over the respective groove **37, 38, 39** or **40**, for easy and intentional breakage of the said film by the finger's end of the user. Other features of the main constituents attached with similar reference numerals at those used in FIG. 4, yet newly affixed with three primes such as **1'''**, **2'''** and **5'''** are substantially same as before, and thus no further description may be required for clarifying the invention.

In FIG. 12, an array of a number of yarn packages adapted for being received in a larger shipping container, not shown, is shown in section, each constituent package of which representing substantially the features shown in FIG. 5, and therefore same reference numerals have been adopted for better identification. In this case, there is provided a tongue-and-groove connection **106** between each pair of two neighboring intermediate pads **16**. It can be seen that any fear of relative movement of constituting yarn packages will arise. These intermediate pads **16** may be of same configuration and dimensions to each other. It is only necessary to arrange neighboring package tiers in the reversed position with each other. Although not shown, each of the end pads may be preferably provided with similar stepped configuration so as to establish the above kind of tongue-and-groove connection.

What I claim is:

1. In a yarn package containing a mass of wound yarn on a core enclosed by means of a protecting heat shrinkable film, the improvement comprising: a ring pad of foamed synthetic resin covering each of the end surfaces of said wound yarn mass, a central bore in each ring pad, each pad having a thickness greater than the length of a cooperating exposed end of said core such that said exposed end extends partially within the bore, the diameter of said bore being smaller than the diameter of the cooperating core end so as to engage said core with a resilient pressure, the outer peripheral surface of said yarn mass being entirely enclosed by said protecting film, said film further enclosing substantially all of the outer end surfaces of the end pads excepting a limited central area, whereby said limited central area is left uncovered to prevent crinkling of said film.

2. In a yarn package containing a plurality of masses of wound yarn on a plurality of cores arranged in a stack by means of a heat shrinkable protecting film, the improvement comprising: an end ring pad of foamed synthetic resin covering each of the outer end surfaces of said yarn masses of said stack, intermediate ring pads of foamed synthetic resin provided between cooperating ends of said yarn masses of said stack, a central bore in each of the end and intermediate ring pads into which a cooperating protruding end of said core partially extends, the diameter of said bores being smaller than the diameter of said corresponding ends of said core so as to engage said core with a resilient pressure, the outer peripheral surface of said yarn mass being entirely enclosed by said heat-shrunk protecting film said film further enclosing and being in intimate contact with the outer peripheral edge of both said end and said intermediate ring pads, and in intimate contact with substantially all of the outer end surfaces of the end pads excepting a limited central area, whereby said limited central area is left uncovered to prevent crinkling of said film.

3. A yarn package as set forth in claim **1**, wherein said foamed synthetic resin for said pad is a member selected from the group consisting of polyurethane, polyethylene and polypropylene.

4. A yarn package as set forth in claim **1**, wherein said protecting film is made of a member selected from the group consisting of polyvinyl chloride, polyvinylidene chloride, polypropylene, and polyamide.

5. A yarn package as set forth in claim **1**, wherein the outer diameter of each of said pads is larger than that of the yarn mass.

6. A yarn package as set forth in claim **1**, wherein each of said pads includes a bore having a reduced diameter portion formed by a stepped portion within said bore.

7. A yarn package as set forth in claim **1**, wherein a shoulder is formed on the outer peripheral surface of each of said pads, for the convenience of providing an array of a number of yarn packages.

8. A yarn package as set forth in claim **1**, wherein said protecting film is heat shrunk from a film cylinder fitted with a plurality of spaced cut-in slits along the peripheral edge of at least one end thereof.

9. A yarn package as set forth in claim **1**, wherein each of said end pads is formed with a circular and concentric groove for easy intentional breakage of the protecting heat-shrunk film.

10. A yarn package as set forth in claim **1**, wherein each of said end pads is formed with a plurality of radial recesses for easy intentional breakage of the protecting heat-shrunk film.

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