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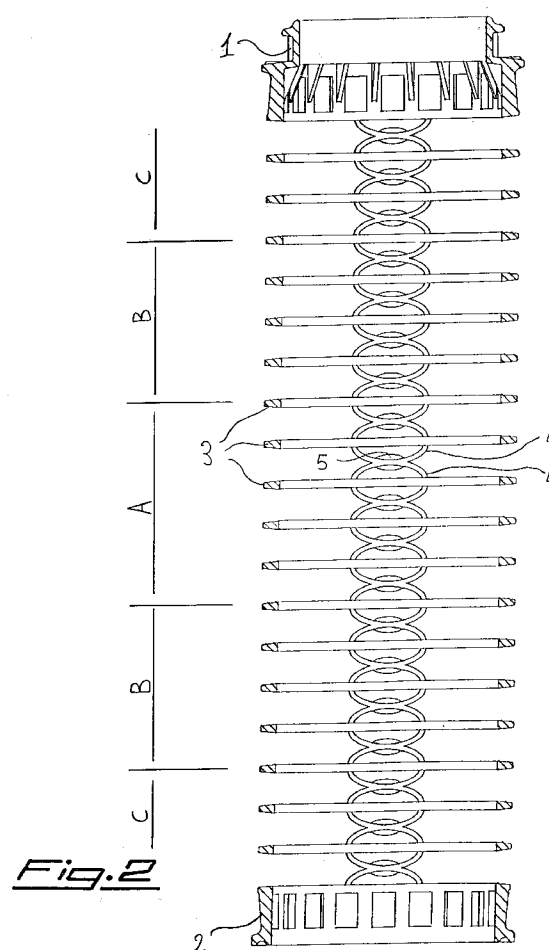
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(54) **A dyeing tube having uniform and controlled axial compressibility.**

(57) A dyeing tube includes a plurality of coaxial rings (3) each of which is connected to the adjacent rings (3) through a plurality of pliable linking members consisting in a pair of opposing arcs (4, 4') having a wide bending radius, the chord of each arc being a length of the upper or lower surface of a ring (3), said pair of arcs (4, 4') being centrally united at a spacer (5) projecting above and below inside the two arcs (4, 4') for an overall height equal to the distance between two adjacent rings (3) in the compressed condition of the tube. The thickness of the arcs (4, 4') progressively increases in a symmetrical way from the tube central portion (A) towards the ends.



The present invention concerns tubes for winding yarns subjected to dyeing, and in particular a dyeing tube having uniform and controlled axial compressibility.

It is known that yarns which are being subjected to dyeing processes are wound on tubes or bobbins, usually made of a plastic material, which are then inserted on proper tubular supports and axially compressed in order to increase the compactness of the wound yarn and to reduce the space occupied.

Prior art dyeing tubes essentially consist of a plurality of coaxial rings having the same diameter which are mutually connected through pliable linking members so as to form a cylindrical structure. However, prior art tubes include linking members which have several drawbacks when they undergo an elastic deformation upon compression.

Italian patent n.1.217.969 discloses a tube provided with pliable linking members inclined with respect to the longitudinal axis of the tube. This kind of pliable members involves an axial torsion of the tube caused by the rotation of the rings around said axis upon compression of the tube. Therefore, the tube may buckle in an asymmetric way, causing stretching and tangling of the yarn near the tube surface with a consequent difficulty in unwinding the yarn at the end of the dyeing operation.

Other types of dyeing tubes are provided with members which get deformed without causing the torsion of the tube. However, they are essentially thin bridges subjected to a progressive yielding due to the chemical substances and the thermal cycles to which they are exposed; this treatment may eventually result in excessive plastic deformations or even breakage.

Furthermore, prior art dyeing tubes are made with a uniform structure along their whole length. In this way, upon compression on the tubular support, end portions get deformed first. Therefore, the resulting deformation is not uniform along the tube, with rubbing and tangling which hinder the unwinding and make the dyeing non-homogeneous.

Therefore, the object of the present invention is to provide a dyeing tube which overcomes the above-mentioned drawbacks.

This object is achieved by means of a tube having the characteristics cited in claim 1.

A first advantage of the tube according to the present invention is to allow a uniform distribution of the compression on the whole length of the tube, thus reducing the risks of tangling.

A second advantage of this tube is that it gets compressed without any torsion.

A further advantage of the present tube comes from the particular geometry of the pliable members, which allow a proper axial deformation of the tube yet resulting very resistant to yielding and maintaining their elasticity characteristics for a long time.

These and other advantages and characteristics of the tube according to the present invention will be apparent from the following detailed description of a preferred embodiment thereof, reported as a non-limiting example, referring to the annexed drawings wherein:

Fig.1 is a perspective view of a tube according to the invention in the extended condition;

Fig.2 is a partial view in longitudinal section of the tube of fig.1; and

Fig.3 is a partial schematic view showing a length of tube in the compressed condition.

As shown in figs.1 and 2, the dyeing tube according to the present invention includes two annular end portions, of which the upper portion 1 has an outside diameter smaller than the inside diameter of the lower portion 2 so as to allow the stacking of the tubes on the supporting bar. The tube body is made up of a plurality of intermediate rings 3 which are equidistant and coaxial to said ends 1 and 2. A plurality of pliable linking members is arranged along the whole circumference of rings 3.

Referring in particular to fig.2, wherein a single "column" of linking members is illustrated, there is seen that each of said members consists in a pair of opposing arcs 4, 4' having a wide bending radius, the chord of each arc being a length of the upper (4) or lower (4') surface of a ring 3. The pair of arcs 4, 4' is centrally united at a spacer 5 projecting above and below inside the two arcs 4, 4', with a bend opposite to that of the arc inside which it projects. Said spacer 5 carries out the double function of distance piece between rings 3 in the compressed condition, as shown in fig.3, and of reinforcement in the point of connection between the opposing arcs 4, 4'.

As it is apparent from fig.1, the depth of arcs 4, 4' in the radial direction is equal to that of rings 3, whereby these members form a single yarn winding surface. On the contrary, the depth of spacers 5 is shorter, and they result recessed with respect to said winding surface, so that during the compression step there is no risk of picking the yarn between spacer 5 and rings 3 abutting thereon.

It is apparent that the structure above has high characteristics of symmetry and stability, and it does not produce any torsion when it is compressed. Moreover, the structure of the linking members implies that their pliability essentially results from their particular geometry, rather than from their reduced thickness as in prior art tubes, whereby they maintain high characteristics of elasticity and strength and the tube life is increased.

A further characteristic of the tube according to the present invention is the change in the thickness of arcs 4, 4', which can not be seen in the figures because of their scale. As shown in fig.2, in order to achieve a uniform compression on the whole tube length, the arcs in the central portion A have a thickness

smaller than those in the intermediate portions B, which in turn have a thickness smaller than those in the end portions C. In this way, the tendency of the tube to get more compressed at the end portions is compensated by the greater strength of the linking members in said portions, thus achieving a uniform distribution of the compression on the whole tube length.

It is clear that the above-described and illustrated embodiment is just an example susceptible of various modifications, such as, for example, the shape of spacer 5 or the number and arrangement of arcs 4, 4' along the circumference of rings 3. Furthermore, the tube shape could be conical or the like, according to the operating requirements.

The tube according to the present invention is preferably made of a plastic material, but it could also be made of other elastically pliable materials whenever particular needs require this.

Claims

1. A dyeing tube including a plurality of coaxial rings (3) each of which is connected to the adjacent rings (3) through a plurality of pliable linking members arranged along the circumference thereof, characterized in that said each of said pliable linking members consists in a pair of opposing arcs (4, 4') having a wide bending radius, the chord of each arc being a length of the upper or lower surface of a ring (3), said pair of arcs (4, 4') being centrally united at a spacer (5) projecting above and below inside the two arcs (4, 4') for an overall height equal to the distance between two adjacent rings (3) in the compressed condition of the tube.
2. A tube according to claim 1, characterized in that the thickness of the arcs (4, 4') progressively increases in a symmetrical way from the tube central portion (A) towards the ends.
3. A tube according to claim 1 or 2, characterized in that the spacer (5) has a radial depth shorter than the arcs (4, 4') and results recessed with respect to the yarn winding surface defined by the arcs (4, 4') together with the rings (3).
4. A tube according to any of the claims 1 to 3, characterized in that the pliable linking members are aligned in the longitudinal direction along a same radial line.

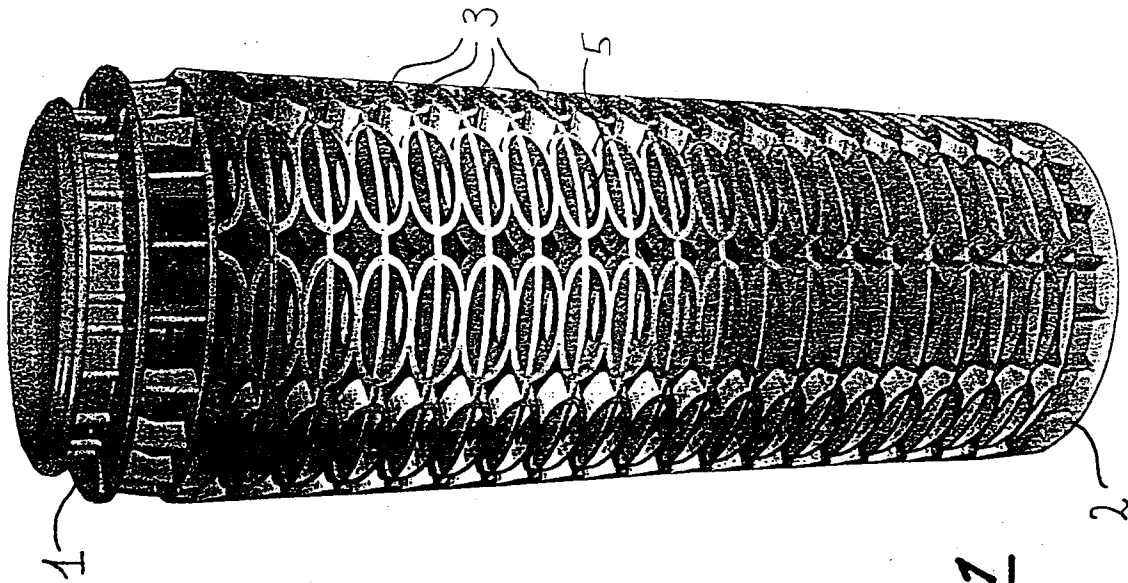
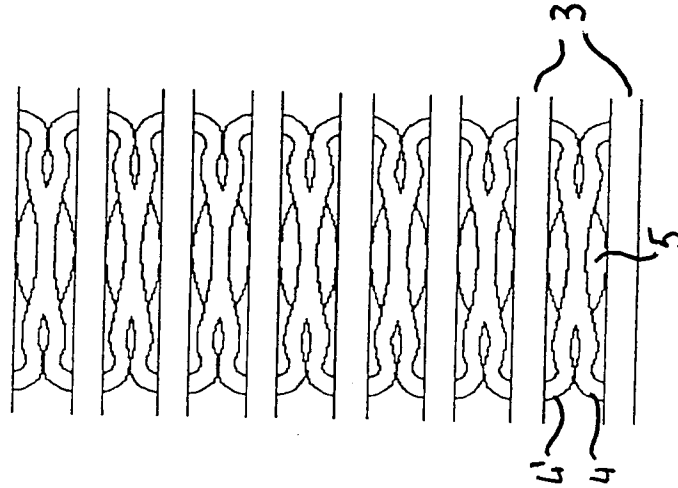
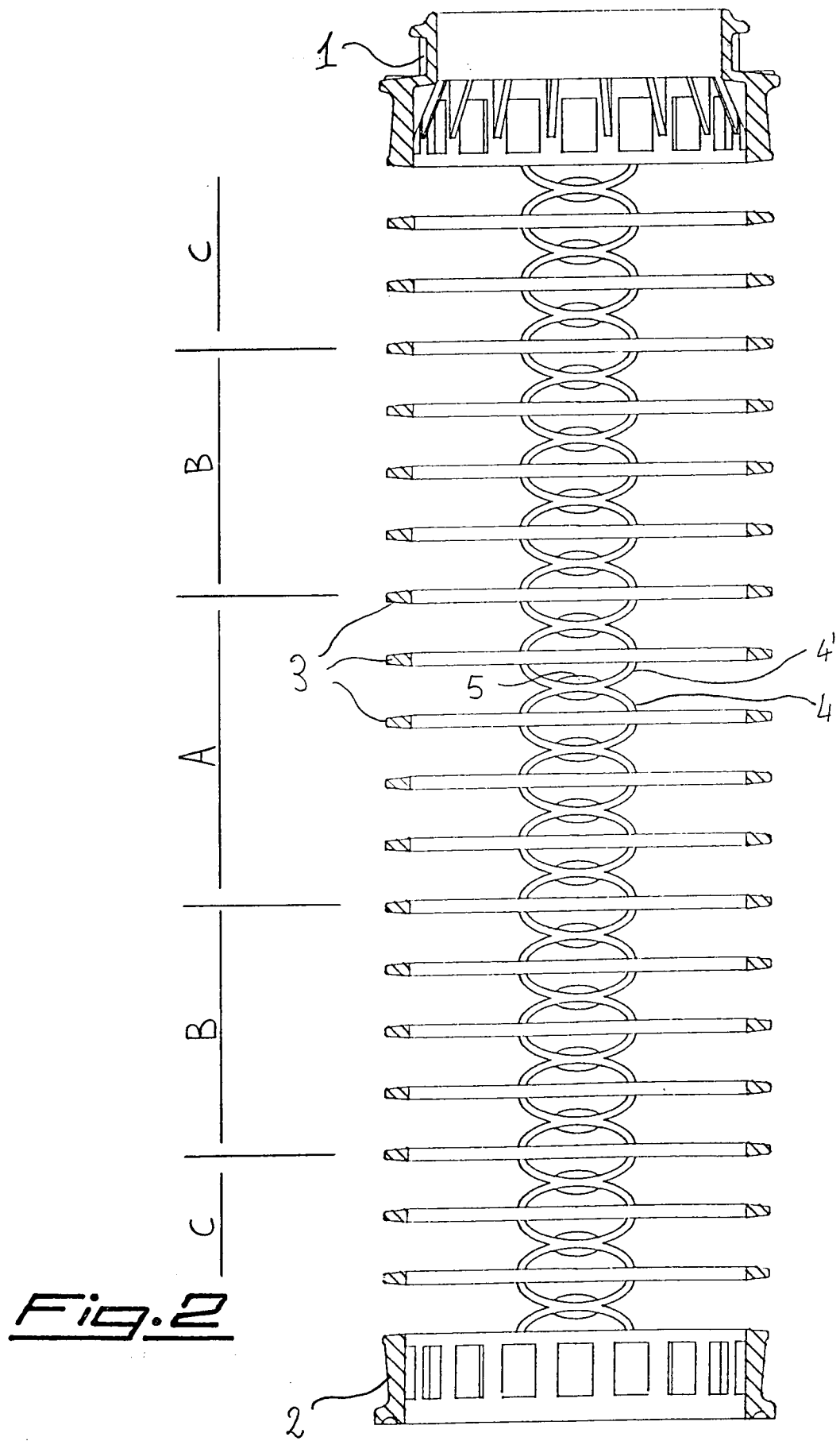


Fig. 1

Fig. 3







European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 94 83 0501

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	EP-A-0 469 394 (TUBETTIFICIO EUROPA) * the whole document *	1, 3, 4	D06B23/04
A, D	EP-A-0 348 721 (TUBETTIFICIO EUROPA) & IT-A-1 217 969	1	
A	FR-A-2 626 296 (BECKER)		
A	DE-A-14 60 211 (BUDDECKE)		
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.6) D06B
Place of search THE HAGUE		Date of completion of the search 10 February 1995	Examiner Petit, J-P
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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